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PERFORMANCE OF MULTIPLE NOZZLE EDUCTOR SYSTEMS WITH SEVERAL GEOMETRIC CONFIGURATIONS.

Robert James Lemke



NPS 69-78-016

NAVAL POSTGRADUATE SCHOOL Monterey, California



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PERFORMANCE OF MULTIPLE NOZZLE EDUCTOR SYSTEMS WITH SEVERAL GEOMETRIC CONFIGURATIONS

by

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September 1978

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Cold flow tests of a four nozzle eductor system were conducted to evaluate the system's performance with the following geometric modifications: changing the area ratio of the mixing stack to primary flow nozzles from 3.0 to 2.5; adding a solid diffusor to the exit of the mixing stack; adding two- and three-ring diffusors to the exit of the



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mixing stack; adding film cooling ports along the length of the mixing stack; and combining the effects of film cooling ports, a two-ring diffusor and a shroud. Non-dimensional parameters governing the flow phenomena are developed from a one-dimensional analysis of a simple eductor system based on the conservation of momentum for an incompressible gas. The eductor performance is evaluated in terms of these non-dimensional parameters. Within the range of modifications considered, the configuration with the film cooling ports, shroud and two diffusor rings provided the best overall eductor system performance.



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Performance of Multiple Nozzle Eductor Systems with Several Geometric Configurations

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ABSTRACT

Cold flow tests of a four nozzle eductor system were conducted to evaluate the system's performance with the following geometric modifications: changing the area ratio of the mixing stack to primary flow nozzles from 3.0 to 2.5; adding a solid diffusor to the exit of the mixing stack; adding two- and three-ring diffusors to the exit of the mixing stack; adding film cooling ports along the length of the mixing stack; and combining the effects of film cooling ports, a two-ring diffusor and a shroud. Non-dimensional parameters governing the flow phenomena are developed from a one-dimensional analysis of a simple eductor system based on the conservation of momentum for an incompressible gas. The eductor performance is evaluated in terms of these non-dimensional parameters. Within the range of modifications considered, the configuration with the film cooling ports, shroud and two diffusor rings provided the best overall eductor system performance.



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NOMENCLATURE

English Letter Symbols

```
Area, in.<sup>2</sup>
Α
                Sonic velocity, ft/sec
                Coefficient of discharge
D
                Diameter, in.
Fa
                Thermal expansion factor
Ffr
                Wall skin-friction force, 1bf
                Proportionality factor in Newton's Second Law,
gc
                g_c = 32.174 \text{ lbm-ft/lbf-sec}^2
                Enthalpy, Btu/lbm
h
                Ratio of specific heats
k
L
                Length, in.
P
                Pressure, in. H<sub>2</sub>0
                Atmospheric pressure, in. Hg
Pa
P_v
                Velocity head, in. H<sub>2</sub>0
PMS
                Static pressure along length of mixing stack,
                in. H<sub>2</sub>0
                Gas constant for air, 53.34 ft-lbf/lbm-°R
R
                Entropy, Btu/lbm-°R
s
S
                Distance from primary nozzle exit to mixing
                stack or entrance transition entrance, in.
\mathbf{T}
                Absolute temperature, °R
                Internal energy, Btu/lbm
                Velocity, ft/sec
U
                Specific volume, ft<sup>3</sup>/lbm
```



- W Mass flow rate, lbm/sec
- x Axial distance from the entrance of the mixing stack, in.
- Y Expansion factor

Dimensionless Groupings

A* - Secondary flow area to primary flow area ratio

AR - Area ratio

f - Friction factor

K - Flow coefficient

K_e - Kinetic energy correction factor

K_m - Momentum correction factor at the mixing
stack exit

M - Mach number

ΔP* - Pressure coefficient

PMS* - Mixing stack pressure coefficient

Re - Reynolds Number

T* = TF* - Absolute temperature ratio of the film flow
to primary flow

T* = TS* - Absolute temperature ratio of the secondary flow to primary flow

W* = WS* - Secondary mass flow rate to primary mass
flow rate ratio



W* = WT* - Tertiary mass flow rate to primary mass
flow rate ratio

X/D - Ratio of distance from entrance of mixing stack to diameter of mixing stack

ρ* - Induced flow density to primary flow density

Greek Letter Symbols

μ - Absolute viscosity, lbf-sec/ft²

ρ - Density, lbm/ft³

 ψ - Split ring diffusor included angle

Subscripts

O - Section within secondary air plenum

Section at primary nozzle exit

2 - Section at mixing stack exit

f - Film cooling

m - Mixed flow or mixing stack

or - Orifice

p - Primary

s - Secondary

t - Tertiary

u - Uptake

w - Mixing stack inside wall

Tabulated Data

MU - Uptake Mach number

PA-PNZ - Pressure differential across secondary flow nozzles, in. H₂0

PA-PS - Static pressure at mixing stack entrance



PMS	-	Mixing stack static pressure, in. H ₂ 0
PTA	-	Velocity pressure head distribution at mixing stack exit along a diagonal traverse, in. ${\rm H}_2^{0}$
PTB	-	Velocity pressure head distribution at mixing stack exit along a horizontal traverse, in. ${\rm H_2}^{0}$
PU-PA	-	Static uptake pressure, in. H ₂ 0
UM	-	Average velocity in mixing stack, ft/sec
UP	-	Primary flow velocity at primary nozzle exit, ft/sec
טט	-	Primary flow velocity in uptake, ft/sec
VA	-	Diagonal velocity traverse at mixing stack exit, ft/sec
VB	-	Horizontal velocity traverse at mixing stack exit, ft/sec
VAV	-	Average mixing stack exit velocity



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I. INTRODUCTION

With gas turbines becoming a more popular means of powering naval vessels, special considerations need to be given to their particular air breathing and exhausting characteristics. With air-fuel ratios of four to five times that of conventional steam plants and the requirement for a relatively large amount of combustion air, a large quantity of hot exhaust gas is generated. Due to gas turbine design, these exhaust gases are at temperatures significantly above those of conventionally powered ships. A few of the problems caused by these high temperatures are thermal damage to electronic equipment located in the mast of these ships, hot gas corrosion of the mast and other superstructures located in the hot gas wake, and a significant infrared radiation signature created by the hot gas plume and hot external surfaces of the stack.

This thesis is an extension of research done by Ellin [1]¹ and Moss [2] to determine better geometric designs for the exhaust plenum and mixing stack system of gas turbine powered naval ships.

Ellin initiated the work by constructing an eductor model testing facility consisting of an uptake, primary flow nozzle,

¹ Numbers in brackets correspond to the reference numbers in the Bibliography.



mixing stack, a means to control and measure the primary air flow, and a means to measure the secondary air flow; see Figure 1. The primary air flow in the testing facility represents a gas turbine's hot exhaust gas. The secondary air flow is ambient air induced into the entrance of the mixing stack by the primary air flow; see Figure 2. From Ellin's study of multiple nozzle flow systems consisting of several identical round nozzles, it was determined that four primary flow nozzles were preferable to either three or five, and that nozzle length has little or no effect on the eductor system's overall performance. Ellin then verified the independence of the one-dimensional model correlation parameters used on flow rate or Mach number. He determined that for Mach numbers from 50% to 145% of the design Mach number of 0.064, the correlation parameters suggested in the one-dimensional analysis did in fact provide good correlation of the data.

Moss' work followed, and it initially consisted of verifying the one-dimensional analysis as did Ellin. He then tested the effect of the stand off distance (that distance between the exit plane of the primary flow nozzles and the entrance plane of the mixing stack). For the primary flow nozzles he tested, Moss determined that the optimum stand off distance for maximum eductor pumping was a distance equal to 0.5 diameters (0.5 $\rm D_m$) of the mixing stack. An independent investigation of this, conducted by Harrell [3], confirmed Moss' findings. Moss then investigated the effects of a conical transition placed on the entrance to the mixing stack.



He concluded that a straight mixing stack without an entrance transition provided a better system performance.

This current study, using the same basic testing facility, investigates the results of changing the primary flow nozzle to mixing stack area ratio, modifying the exit geometry of the mixing stack, and adding film cooling along the length of the stack. An overall mixing stack length of 2.5 D was chosen for testing as it was considered representative of mixing stack lengths used in gas turbine powered ships.

Figures 1 and 2 provide a schematic representation of the model testing facility. Figures 3, 4, and 5 illustrate the locations of, and the terminology used, to define the air flows.

The area ratio of the mixing stack to primary air flow nozzles was changed to reduce the uptake back pressure which is of concern because excessive uptake back pressure significantly reduces gas turbine operating efficiency. However, by lowering the uptake back pressure the primary nozzle exit velocity is reduced, and, therefore, the secondary air flow is also lowered. This loss in secondary air flow can be compensated for with modification to the mixing stack exit geometry and the addition of film cooling ports.

The primary flow nozzles tested in this study are pictured in Figure 6 and shown dimensionally in Figure 7. The straight stack tested is dimensionally illustrated in Figure 8 and pictured in Figure 9.



Three modifications of the straight mixing stack exit geometries were investigated: a solid diffusor dimensionally illustrated in Figure 10 and pictured in Figure 11, a two-ring diffusor dimensionally illustrated in Figure 12 and pictured in Figure 13, and a three-ring diffusor dimensionally illustrated in Figure 14 and pictured in Figure 15. The addition of diffusor rings on the mixing stack introduced a tertiary air flow through the rings as shown in Figure 4.

Additional modifications to the eductor system were made by cutting ports into the mixing stack as shown in Figures 16 and 17. Air induced through these ports is termed film cooling air; see Figure 5. Tertiary and film cooling air is induced, ambient air with the primary purpose of convectively cooling the eductor system. This is contrasted with secondary air flow which is ambient air predominantly intended to reduce exhaust gas temperature by mixing.

The combining of the diffusor rings and the ported mixing stack, as shown in Figures 18 and 19, constituted the next eductor system tested.

The final model tested had a shroud added to the eductor system as shown in Figures 20, 21, and 22. The shroud was designed to direct the film cooling air along the exterior of the mixing stack to reduce the heat transfer between the mixing stack and the shroud. This acts as a thermal shield of the hot mixing stack to further reduce infrared radiation in addition to providing the source of air for the film cooling ports.



Evaluation of eductor system performance was measured in four areas: the amount of secondary air flow induced by the primary air flow, the degree of mixing of primary and induced air flows within the mixing stack system, the amount of uptake back pressure impressed upon the turbine exhaust by the eductor system, and the amount of film cooling air available to reduce the exterior stack temperature of the eductor system.

The key factor which allows cold flow testing to predict the effects of a hot gas eductor system is the similarity of the momentum and energy transfer mechanisms in turbulent flows. The momentum correction factor, defined as the ratio of the actual momentum rate to the pseudo-rate based on the average velocity, is used as a measure of the degree of mixing at the exit plane of the mixing stack. Another measure of the degree of mixing is the ratio of the peak exit velocity to uptake velocity which also reflects the peak to average temperature ratios. Both these means were utilized in the evaluation of eductor system mixing abilities.



II. THEORY AND ANALYSIS

This investigation, being an extension of the work of Ellin [1] and Moss [2], uses the same one-dimensional analysis of a simple eductor system. Similarity between the basic geometry tested by Ellin and Moss was maintained in order to correlate data. The dimensionless parameters controlling the flow phenomenon used by Ellin were also used in this investigation along with the basic means of data analysis and presentation. Dynamic similarity was maintained by using Mach number similarity to establish the model's primary flow rate.

Although the analysis presented here is for an eductor model with only primary and secondary air flows, it should be kept in mind that many of the results presented are for systems with primary, secondary, and tertiary air flows. Systems with tertiary and film cooling air flows have been non-dimensionalized with the same base parameters as the secondary air flow and have been calculated using the same one-dimensional analysis. This allows for easy comparison of the results. Parameters pertaining to the secondary systems are subscripted with an "s", those relating to the tertiary box are subscripted with a "t", and those relating to film cooling air with an "f".

A. MODELING TECHNIQUE

Dynamic similarity between the models tested and the actual prototype was maintained by using the same primary air flow



Mach number. For the primary air flow Mach number used (0.064), and based on the average flow properties within the mixing stack and the diameter of the mixing stack, the air flow through the eductor system is turbulent (Re > 10⁵). As a consequence of this, momentum exchange is predominant over shear interaction, and the kinetic and internal energy terms are more influential on the flow than are viscous forces. It can also be shown that the Mach number represents the ratio of kinetic energy of a flow to its internal energy and is, therefore, a more significant parameter than the Reynolds number in describing the primary flow through the uptakes.

B. ONE-DIMENSIONAL ANALYSIS OF A SIMPLE EDUCTOR

The theoretical analysis of an eductor may be approached in two ways. One method attempts to analyze the details of the mixing process of the primary and secondary air streams as it takes place inside the mixing stack. This requires an interpretation of the mixing phenomenon which, when applied to a multiple nozzle system, becomes extremely complex. The other method, which was chosen here, analyzes the overall performance of the eductor system and is not concerned with the actual mixing process. The one-dimensional analysis is based on a single primary nozzle exhausting into a mixing stack, as shown in Figure 23. To avoid repetition with previous reports, only the main parameters and assumptions will be represented here. A complete derivation of analysis used can be found in references [1] and [4]. The one-dimensional



flow analysis of the simple eductor system described depends on the simultaneous solution of the continuity, momentum and energy equations coupled with the equation of state, all compatible with specific boundary conditions.

The idealizations made for simplifying the analysis are as follows:

- 1. The flow is steady state and incompressible.
- 2. Adiabatic flow exists throughout the eductor with isentropic flow of the secondary stream from the plenum (at section 0) to the throat or entrance of the mixing stack (at section 1) and irreversible adiabatic mixing of the primary and secondary streams occurs in the mixing stack (between sections 1 and 2).
- 3. The static pressure across the flow at the entrance and exit planes of the mixing-tube (at sections 1 and 2) is uniform.
- 4. At the mixing-stack entrance (section 1) the primary flow velocity \mathbf{U}_{p} and temperature \mathbf{T}_{p} are uniform across the primary stream, and the secondary flow velocity \mathbf{U}_{s} and temperature \mathbf{T}_{s} are uniform across the secondary stream, but \mathbf{U}_{p} does not equal \mathbf{U}_{s} , and \mathbf{T}_{p} does not equal \mathbf{T}_{s} .
- 5. Incomplete mixing of the primary and secondary streams in the mixing stack is accounted for by the use of a non-dimensional momentum correction factor $\mathbf{K}_{\mathbf{m}}$ which relates the actual momentum rate to the pseudo-rate based on the bulk-average velocity and density and by the use of a non-dimensional kinetic energy correction factor $\mathbf{K}_{\mathbf{p}}$ which relates the actual kinetic energy rate



to the pseudo-rate based on the bulk-average velocity and density.

- 6. Both gas flows behave as perfect gases.
- 7. Flow potential energy of position changes are negligible.
- ⁸. Pressure changes P_{so} to P_{sl} and P_{l} to P_{a} are small relative to the static pressure so that the gas density is essentially dependent upon temperature (and atmospheric pressure).
- 9. Wall friction in the mixing stack is accounted for with the conventional pipe friction factor term based on the bulk-average flow velocity $\mathbf{U}_{\mathbf{m}}$ and the mixing stack wall area $\mathbf{A}_{\mathbf{u}}$.

The following parameters, defined here for clarity, will be used in the following development.

area ratio of primary flow area to mixing stack cross sectional area

W/Aarea ratio of wall friction area to mixingmstack cross sectional area

 ${\tt K}_{\tt p}$ momentum correction factor for primary flow ${\tt K}_{\tt m}$ momentum correction factor for mixed flow.

f wall friction factor

Based on the continuity equation, the conservation of mass principle for steady flow yields



$$W_{m} = W_{p} + W_{s} + W_{t} \tag{1}$$

where

$$W_{p} = \rho_{p}U_{p}A_{p}$$

$$W_{s} = \rho_{s}U_{s}A_{s}$$

$$W_{t} = \rho_{t}U_{t}A_{t}$$

$$W_{m} = \rho_{m}U_{m}A_{m}$$
(1a)

All of the above velocity and density terms, with the exception of ρ_m and U_m , are defined without ambiguity by the virtue of idealizations (3) and (4) above. Combining equations (1) and (1a) above, the bulk average velocity at the exit plane of the mixing stack becomes

$$U_{\rm m} = \frac{W_{\rm s} + W_{\rm t} + W_{\rm p}}{\rho_{\rm m} A_{\rm m}} \tag{1b}$$

where A_{m} is fixed by the geometric configuration and

$$\rho_{\rm m} = \frac{P_{\rm a}}{RT_{\rm m}} \tag{2}$$

where $T_{\rm m}$ is calculated as the bulk average temperature from the energy equation (9) below. The momentum equation stems from Newton's second and third laws of motion and is the conventional force and momentum-rate balance in fluid mechanics.



$$K_{p}\left[\frac{W_{p}U_{p}}{g_{c}}\right] + \left[\frac{W_{s}U_{s}}{g_{c}}\right] + \left[\frac{W_{t}U_{t}}{g_{c}}\right] + P_{1}A_{1} = K_{m}\left[\frac{W_{m}U_{m}}{g_{c}}\right] + P_{2}A_{2} + F_{fr}$$
(3)

Note the introduction of idealizations (3) and (5). To account for a possible non-uniform velocity profile across the primary nozzle exit, the momentum correction factor K_p is introduced here. It is defined in a manner similar to that of K_m and by idealization (4), supported by work conducted by Moss, it is set equal to unity. K_p is carried through this analysis only to illustrate its effect on the final result. The momentum correction factor for the mixing stack exit is defined by the relation

$$K_{m} = \frac{1}{W_{m}U_{m}} \int_{0}^{A_{m}} U_{m}^{2} \rho_{2} dA \qquad (4)$$

where $\mathbf{U}_{\mathbf{m}}$ is evaluated as the bulk-average velocity from equation (lb). The wall skin friction force $\mathbf{F}_{\mathbf{fr}}$ can be related to the flow stream velocity by

$$F_{fr} = f A_{w} \left[\frac{U_{m}^{2} \rho_{m}}{2g_{c}} \right]$$
 (5)

using idealization (9). As a reasonably good approximation for turbulent flow, the friction factor may be calculated from the Reynolds number



$$f = 0.046 (Re_m)^{-0.2}$$
 (6)

Applying the conservation of energy principle to the steady flow system in the mixing stack between the entrance and exit planes,

$$W_{p}[h_{p} + \frac{U_{p}^{2}}{2g_{c}}] + W_{s}[h_{s} + \frac{U_{s}^{2}}{2g_{c}}] + W_{t}[h_{t} + \frac{U_{t}^{2}}{2g_{c}}]$$

$$= W_{m}[h_{m} + K_{e} \frac{U_{m}^{2}}{2g_{c}}]$$
(7)

neglecting potential energy of position changes (idealization 7). Note the introduction of the kinetic energy correction factor K_{ρ} , which is defined by the relation

$$K_{e} = \frac{1}{W_{m}U_{m}^{2}} \int_{0}^{A_{m}} U_{2}^{3} \rho_{2} dA$$
 (8)

It may be demonstrated that for the purpose of evaluating the mixed mean flow temperature $\mathbf{T}_{\mathbf{m}}$, the kinetic energy terms may be neglected to yield

$$h_{m} = \frac{\overline{W}_{p}}{\overline{W}_{m}} h_{p} + \frac{\overline{W}_{s}}{\overline{W}_{m}} h_{s} + \frac{\overline{W}_{t}}{\overline{W}_{m}} h_{t}$$
 (9)

where $T_m = \phi(h_m)$ only, with idealization (6).

The energy equation for the isentropic flow of the secondary air from the plenum to the entrance of the mixing



stack may be shown to reduce to

$$\frac{P_{O} - P_{S}}{\rho_{S}} = \frac{U_{S}^{2}}{2g_{C}}$$
 (10)

similarly, the energy equation for the tertiary air flow reduces to

$$\frac{P_{o} - P_{t}}{\rho_{t}} = \frac{U_{t}^{2}}{2g_{c}}$$

The foregoing equations may be combined to yield the vacuum produced by the eductor action in either the secondary or tertiary air plenums. For the secondary air plenum, the vacuum produced is

$$P_{a} - P_{os} = \frac{1}{g_{c} A_{m}} \left\{ K_{p} \frac{W_{p}^{2}}{A_{p} \rho_{p}} + \frac{W_{s}^{2}}{A_{s} \rho_{s}} \left[1 - \frac{1}{2} \frac{A_{m}}{A_{s}}\right] - \frac{W_{m}^{2}}{A_{m} \rho_{m}} \left[K_{m} + \frac{f}{2} \frac{A_{w}}{A_{m}}\right] \right\}$$
(11)

where it is understood that A_p and ρ_p apply to the primary flow at the entrance to the mixing stack, A_s and ρ_s apply to the secondary flow at this same section, and A_m and ρ_m apply to the mixed flow at the exit of the mixing stack system. P_a is atmospheric pressure, and is equal to the pressure at the exit of the mixing stack. A_w is the area of the inside wall of the mixing stack.



For the tertiary air plenum, the vacuum produced is

$$P_{a} - P_{ot} = \frac{1}{g_{c}^{A_{m}}} \left\{ K_{p} \frac{\left(W_{p} + W_{s}\right)^{2}}{\left(A_{p}^{\rho}_{p} + A_{s}^{\rho}_{s}\right)} + \frac{W_{t}^{2}}{A_{t}^{\rho}_{t}} \left[1 - \frac{1}{2} \frac{A_{m}}{A_{t}}\right] - \frac{W_{m}^{2}}{A_{m}^{\rho}_{m}} \left[K_{m} + \frac{f}{2} \frac{A_{w}}{A_{m}}\right] \right\}$$
(11a)

where the primary flow now consists of both the primary and secondary air flows.

C. NON-DIMENSIONAL FORM OF THE SIMPLE EDUCTOR EQUATION

In order to provide the criteria of similarity of flows with geometric similarity, the non-dimensional parameters which govern the flow must be determined. The means chosen for determining these parameters is to normalize equations (11) and (11a) with the following dimensionless groupings.

$$\Delta P^* = \frac{\frac{P_a - P_{os}}{\rho_s}}{\frac{U_p}{2g_c}}$$

a pressure coefficient which compares the pumped head P_a-P_o for the secondary flow to the driving head $\frac{U}{2g}$ of the primary flow

$$\Delta PT^* = \frac{\frac{P_t^{-P} \text{ ot}}{\rho_t}}{\frac{U_p^2}{2g_c}}$$

a pressure coefficient which compares the pumped head P_a - P_o for the tertiary flow to the driving head $\frac{D}{2g}$ of the primary flow



$$Ws^* = \frac{W_s}{W_p}$$

a flow rate ratio, secondary to primary mass flow rate

$$WT^* = \frac{W}{W_p}$$

a flow rate ratio, tertiary to primary mass flow rate

$$TS* = \frac{T_s}{T_p}$$

an absolute temperature ratio, secondary to primary

$$T_t^* = \frac{T_t}{T_p}$$

an absolute temperature ratio, tertiary to primary

$$\rho_{s}^{*} = \frac{\rho_{s}}{\rho_{p}}$$

a flow density ratio of the secondary to primary flows. (Note that since the fluids are considered perfect gases,

$$\rho_{s}^{*} = \frac{T_{p}}{T_{s}} = \frac{1}{T_{s}^{*}}$$

$$\rho_{t}^{*} = \frac{\rho_{t}}{\rho_{p}}$$

a flow density ratio of the tertiary flow to primary flows. (Note that since the fluids are considered perfect gases,

$$\rho_{t}^{*} = \frac{T_{p}}{T_{t}} = \frac{1}{T_{t}^{*}})$$

$$A_{S}^{*} = \frac{A_{S}}{A_{D}}$$

an area ratio of secondary flow area to primary flow area

$$A_t^* = \frac{A_t}{A_p}$$

an area ratio of tertiary flow area to primary flow area

With these non-dimensional groupings, equations (11) and (11a) can be rewritten in dimensionless form. Since both



equations follow the same format, only the results for the secondary air plenum will be presented here.

$$\frac{\Delta_{P}^{\star}}{T^{\star}} = 2 \frac{A_{p}}{A_{m}} \{ [K_{p} - \frac{A_{p}}{A_{m}} \beta] - W^{\star} [K_{p} + T^{\star}] \frac{A_{p}}{A_{m}} \beta$$

$$+ W^{\star}^{2} T^{\star} [\frac{1}{A^{\star}} (K_{p} - \frac{A_{m}}{2A^{\star}A_{p}}) - \frac{A_{p}}{A_{m}} \beta] \}$$
(12)

where

$$\beta = K_{m} + \frac{f}{2} \frac{A_{w}}{A_{m}}.$$

This may be rewritten as

$$\frac{\Delta P^*}{T^*} = C_1 + C_2 W^* (T+1) + C_3 W^{*2} T^*$$
 (13)

where

$$C_1 = 2 \frac{A_p}{A_m} (K_p - \frac{A_p}{A_m} \beta)$$
,
 $C_2 = -2 (\frac{A_p}{A_m})^2 \beta$, and
 $C_3 = 2 \frac{A_p}{A_m} (\frac{1}{A^*} - \frac{A_m}{2A^*A_p} \beta - \frac{A_p}{A_m} \beta)$.

As can be seen from equation (13),

$$\Delta P^* = F(W^*, T^*).$$



The additional dimensionless quantities listed below were used to correlate the static pressure distribution down the length of the mixing stack.

$$PMS* = \frac{\frac{PMS}{\rho}}{\frac{Up^2}{2g_C}}$$

a pressure coefficient which compares the pumping head $\frac{PMS}{\rho_S}$ for the secondary flow to the driving head $\frac{p}{2g}$ of the primary flow, where PMS = static pressure along the mixing stack length

 $\frac{X}{D}$

ratio of the axial distance from the mixing stack entrance to the diameter of the mixing stack

D. EXPERIMENTAL CORRELATION

It is desirable to make a direct comparison of prototype and model performance on a one-to-one basis so that the effects of changes in geometric parameters on eductor performance may be readily evaluated. The ratio of absolute temperatures is the only parameter which was not controlled during the model testing. Therefore a means of presenting the experimental data for a given geometric configuration in a form which results in a pseudo-independence of the dimensionless groupings ΔP^* and W^* upon T^* must be developed. From equation (13) a satisfactory correlation of ΔP^* , T^* , and W^* for all temperatures and flow rates takes the form

$$\frac{\Delta P^*}{T^*} = \phi (W^*T^*)$$
 (14)



where the exponent n is determined to be equal to 0.44. The details of the determination of 0.44 as the correlating exponent for the geometric parameters of the models tested is given in reference [1]. To obtain an eductor model's pumping characteristic curve, the experimental data is correlated and analyzed using equation (14), that is, $\Delta P^*/T^*$ is plotted as a function of W*T**0.44. This correlation is used to predict the open to the environment operating point. Variations in the eductor model's geometry will change the appearance of the pumping characteristic curve and facilitate comparison of pumping ability between models. For ease of discussion, W*T*** will henceforth be referred to as the pumping coefficient.



III. EXPERIMENTAL APPARATUS

Air is supplied to the primary nozzles by means of a centrifugal compressor and associated ducting schematically illustrated in Figure 1. The mixing stack configuration being tested is placed inside an air plenum containing an airtight partition so that two separate air flows, secondary and tertiary, may be measured. The air plenum facilitates the accurate measurement of secondary and tertiary air flows by using ASME long radius flow nozzles.

A. PRIMARY AIR SYSTEM

The circled numbers found in this section refer to locations on Figure 1. The primary air ducting is constructed of 16-gage steel with 0.635 cm (0.25 in.) thick steel flanges. The ducting sections were assembled using 0.635 cm (0.25 in.) bolts with air drying silicone rubber seals between the flanges of adjacent sections. Entrance to the inlet ducting 1 is from the exterior of the building through a 91.44 cm (3.0 ft) square to a 30.48 cm (1.0 ft) square reducer, each side of which has the curvature of a quarter ellipse. A transition section 2 then changes the 30.48 cm (1.0 ft) square section to a 35.31 cm (13.90 in) diameter circular section 3 . This circular section runs approximately 9.14 m (30 ft) to the centrifugal compressor inlet. A standard ASME square edged orifice 4 is located 15 diameters downstream of the entrance



reducer and 11 diameters upstream of the centrifugal compressor inlet, thus insuring stability of flow at both the orifice and compressor inlet. Piezometer rings 5 are located one diameter upstream and one-half diameter downstream of the orifice. The duct section also contains a thermocouple just downstream of the orifice.

A manually operated sliding plate variable orifice (6) was designed to constrict the flow symmetrically and facilitate fine control of the primary air flow. During operation, the butterfly valve (8), located at the compressor's discharge, provided adequate regulation of primary air flow, eliminating the necessity of using the sliding plate valve. The sliding plate valve was positioned in the wide-open position for all data runs.

On the compressor discharge side, immediately downstream of the butterfly valve, is a round to square transition 9 followed by a 90 degree elbow 10 and a straight section of duct. All ducting to this point is considered part of the fixed primary air supply system. A transition section 12 is fitted to this last square section which reduces the duct cross section to a circular section 29.72 cm (11.7 in) in diameter. This circular ducting tapers down to a diameter of 26.30 cm (11.5 in) to provide the primary air inlet to the eductor system being tested. The transition is located far enough upstream of the model to insure that the flow reaching the model is fully developed.



Primary flow is measured by means of a standard ASME square edged orifice designed to the specifications given in the ASME power test code [5]. The 17.53 cm (6.902 in) diameter orifice used was constructed out of 304 stainless steel 0.635 cm (0.25 in) thick. The inside diameter of the duct at the orifice is 35.31 cm (13.90 in) which yields a beta (β = d/D) of 0.497. The orifice diameter was chosen to give the best performance in regard to pressure drop and pressure loss across the orifice over the range of primary air flow rates tested [between 0.907 Kg/sec (2.0 lbm/sec) and 1.814 Kg/sec (4.0 lbm/sec)].

The centrifugal compressor 4 used to provide primary air to the system is a Spencer Turbo Compressor, catalogue number 25100-H, rated at 6000 cfm at 2.5 psi back pressure. The compressor is driven by a three phase, 440 volt, 100 horsepower motor.

B. SECONDARY AIR PLENUM

The secondary air plenum, pictured in Figure 24, is constructed of 1.905 cm (0.75 in) plywood and measures 1.22 m by 1.22 m by 1.88 m (4 ft by 4 ft by 6.17 ft). It serves as an enclosure that can contain all or only part of the eductor model and still allow the exit plane of the mixing stack to protrude. The purpose of the secondary air plenum is to serve as a boundary through which secondary air for the eductor system must flow. Long radius ASME flow nozzles, designed in accordance with ASME power test codes [5] and



constructed of fiberglass, penetrate the secondary air plenum, thereby providing the sole means for metering the secondary air reaching the eductor. Appendix D of Reference [1] outlines the design and construction of the secondary air flow nozzles. By measuring the temperature of the air entering and the pressure differential across the ASME flow nozzles, the mass flow rate of secondary air can be determined. Flexibility is provided in measurement of the mass flow rate of secondary air by employing flow nozzles with three different throat diameters: 20.32 cm (8 in), 10.16 cm (4 in), and 5.08 cm. (2 in). By using a combination of flow nozzles, a wide variety of secondary cross sectional areas can be obtained.

A secondary air flow straightener, shown in Figure 25, consisting of a double screen is installed 1.22 m (4 ft) from the open end of the secondary air plenum, between the ASME long radius nozzles and the primary air flow nozzles. The purpose of the straightener is to reduce any swirl effect that could result when only a small secondary air flow area exists.

C. TERTIARY AIR PLENUM

The tertiary air plenum, pictured in Figures 24 and 26, is constructed of 1.90 cm (0.75 in) plywood and measures 1.22 m by 1.22 m by 1.22 m (4 ft by 4 ft by 4 ft). It serves as an enclosure that completely surrounds the mixing stack and allows the exit and entrance regions to protrude. An airtight rubber diaphragm type seal, schematically illustrated



in Figure 6 and pictured in Figures 27 and 28, is located at each end of the enclosure. This allows measurement of a tertiary air flow independent of the secondary air flow. Tertiary air flow is measured with the use of long radius ASME flow nozzles designed in accordance with ASME test codes [5] and constructed of fiberglass. These nozzles are located so that they penetrate the airtight tertiary air plenum, thereby providing the sole means for metering the tertiary air reaching the inductor. By measuring the temperature of the air entering and the pressure differential across the ASME flow nozzles, the mass flow rate of tertiary air can easily be obtained. Flexibility in measuring the tertiary flow is provided by employing different size flow nozzles: two of 20.32 cm (8 in) throat diameter, three of 10.16 cm (4 in) throat diameter, and two of 5.08 cm (2 in) throat diameter. By using various combinations of these flow nozzles, a wide variety of tertiary cross section flow areas can be obtained.

The interior of the tertiary air plenum is pictured in Figure 29. The stand which holds the mixing stack can be seen mounted inside the plenum. This stand, Figures 30 and 31, provides three axis adjustments to the mixing stack for alignment purposes. Figure 27 shows the diaphragm air seal at the entrance to the mixing stack, and Figure 28 shows the diaphragm air seal at the exit plane of the mixing stack. As can be seen, removable ports were located in the exit



plane door to allow for adjustments to the mixing stack and instrumentation without removing the diaphragms.

D. INSTRUMENTATION

Pressure instrumentation for measuring gage pressures is located inside the primary air uptakes just prior to the primary nozzles, inside the secondary air plenum, inside the tertiary air plenum, and at various points on the model. A variety of manometers, pictured in Figure 32, were used to indicate the pressure differentials. A schematic representation of the pressure measuring instrumentation is illustrated in Figures 33 and 34. Monitoring of each of the various pressures was facilitated by the use of a scanivalve and a multiple valve manifold. The scanivalve was used to select the pressure tap to be read, while the multiple valve manifold allowed selection of the optimum manometer for the pressure being recorded. A vent was included in the multiple valve manifold which provided a means of venting the manometers between pressure readings. The valve manifold provided a selection of a 15.24 cm (6.0 in) inclined water manometer, a 5.08 cm (2.0 in) inclined water manometer, and a 1.27 cm (0.5 in) inclined oil manometer (specific gravity 0.827). In addition, the following dedicated manometers were used in the system: a 43.18 cm (17 in) single column water manometer connected to the primary air flow just prior to the primary nozzles, a 127 cm (50 in) U-tube water manometer with each leg connected to a piezometric ring on either side of the orifice



plate in the air inlet duct, and a 2.54 cm (1.0 in) inclined water manometer connected to the upstream piezometric ring.

Primary air temperatures, measured at the orifice outlet and just prior to the primary nozzles, are measured with copper-constantan thermocouples. The thermocouples are in assemblies manufactured by Honeywell under the trade name Megapak. Polyvinyl covered 20 gage copper-constantan extension wire is used to connect the thermocouples to a Newport Digital Pyrometer, model number 267, which provides a digital display of the measured temperature in degrees Fahrenheit. Secondary/tertiary ambient air temperature is measured with a mercury-glass thermometer and recorded in degrees Fahrenheit.

Velocity profiles at the mixing stack exit plane are obtained by using a pitot tube, pictured in Figure 35.

The tube is affixed to a mounting template which allows accurate determination of both azimuthal and diametral position. Alignment pins allow fast, accurate changes in azimuthal angles. The pitot tube is used in conjunction with the 15.24 cm (6 in) inclined water manometer for obtaining the velocity pressure head.

E. EDUCTOR SYSTEM

The multiple nozzle eductor systems studied are designed specifically for service onboard gas turbine powered ships.

The model consisted of a single primary uptake, a single cluster of four primary nozzles of constant cross section, as pictured in Figure 6, and a single mixing stack. The parameters



varied in this research were the primary nozzle areas, the length of the mixing stack, modifications to the exit region of the mixing stack, the addition of film cooling ports, and a shroud added externally to the mixing stack. Based on the finding of Ellin, four primary flow nozzles were used, and based on Moss' work, a stand off distance of one-half diameter of the mixing stack was used. Maintaining Mach number similarity in the uptakes for all tests facilitated a direct comparison of all mixing stack performances. The uptake parameters and primary nozzle dimensions used correspond approximately to the area ratio used in existing gas turbine powered ships.

F. MODEL GEOMETRIES

A variety of mixing stacks were tested to evaluate the effects that modifications to exit geometry and the addition of stack wall ports had on eductor performance.

1. Straight Mixing Stack

Straight mixing stacks of length to diameter ratios (L/D) of 3.0, 2.5, and 1.75 were tested. These mixing stacks, pictured in Figure 9 and shown dimensionally in Figure 8, were manufactured from 29.72 cm (11.70 in) inside diameter plastic pipe with a nominal wall thickness of 0.64 cm (0.25 in). Additional material was glued to the entrance region to create a 1.25 cm (0.50 in) radius. This allowed for smooth flow of secondary air into the mixing stack and prevented separation



which might have occurred with a square edge. Pressure taps were located along the mixing stack as shown in Figure 8.

2. Straight Mixing Stack With A Solid Diffusor

The straight mixing stack with a solid diffusor is pictured in Figure 11 and dimensionally illustrated in Figure 10. The straight portion of the assembly, which has an L/D = 1.75, was constructed similarly to the straight mixing stack except a flange was affixed onto the end of the straight portion so that a solid diffusor of L/D = 0.75 could be attached. The solid diffusor was constructed out of 0.15 cm (0.06 in) thick aluminum and was fitted with a flange matching the one on the mixing stack. The solid diffusor was constructed with a double included angle of seven degrees. This angle was chosen to prevent flow separation in the diffusor section. When the solid diffusor was attached to the mixing stack, the joint was filled with body putty and faired in to prevent any misalignment from causing flow separation. Pressure taps were located along the mixing stack as shown in Figure 10.

3. Straight Mixing Stack With A Two-Ring Diffusor

The straight mixing stack with a two-ring diffusor is pictured in Figure 13 and dimensionally illustrated in Figure 12. The straight portion of the assembly is constructed identically to a straight mixing stack of L/D=1.75. The diffusor rings were fabricated out of 0.15 cm (0.060 in) thick aluminum alloy which was rolled and then welded into the rings. The welds were dressed down to present the same flow



blockage as the parent diffusor material. The spacers used to attach the diffusor rings to the straight mixing stack and maintain radial separation were desinged to minimize flow disturbance and blockage. The entire assembly had an L/D=2.5. Pressure taps were located along the mixing stack as shown in Figure 12.

4. Straight Mixing Stack With Three-Ring Diffusor

The straight mixing stack with three-ring diffusor is pictured in Figure 15 and dimensionally illustrated in Figure 14. The straight portion of the assembly was constructed identically to a straight mixing stack of L/D = 1.75. The diffusor rings were fabricated out of 0.15 cm (0.060 in) thick aluminum alloy which was rolled and then welded into the rings. The welds were dressed down to present the same flow blockage as the parent diffusor material. Spacers, used to attach the diffusor rings to the straight mixing stack and maintain axial spacing, were designed to minimize flow disturbance and blockage. Pressure taps were located along the mixing stack as shown in Figure 14.

5. Straight Mixing Stack With Ports

The straight mixing stack with an L/D = 2.5 was fitted with rectangular inserts which contained ports pictured in Figure 17 and dimensionally illustrated in Figure 16. This construction allows for change of port geometry without having to fabricate a new mixing stack. The ports used in these experiments were rectangular in shape and measured approximately



9.6 cm by 0.6 cm (3.8 in by 0.25 in). The inserts were placed in four circumferential bands, each band consisting of four equally spaced inserts. These bands were labelled A through D as illustrated in Figure 16. Each successive band of inserts was displaced radially 30 degrees from the previous band to allow for inducement of film cooling air completely around the circumference of the mixing stack. The rectangular port geometry was chosen to minimize the vena contracta effects. The angle of entrance into the mixing stack of 45 degrees was based on geometric flow disturbance considerations. Except for the ports, the inside of the mixing stack was maintained smooth. Pressure taps were located along the mixing stack as shown in Figures 16 and 17.

6. Straight Mixing Stack With Ports And A Two-Ring Diffusor

The straight mixing stack with ports and a two-ring diffusor is pictured in Figure 19 and dimensionally illustrated in Figure 18. This assembly consisted of the straight ported section (L/D = 1.75) tested previously and the two-ring diffusor tested on the straight stack. The assembly has an overall L/D = 2.5. Pressure taps were located along the mixing stack as shown in Figure 18.

7. Straight Mixing Stack With Ports, A Shroud Covering The Ports, And Two-Ring Diffusor (Shrouded, Ported Mixing Stack)

The straight mixing stack with ports, a two-ring diffusor, and shroud is pictured in Figure 21 and dimensionally illustrated in Figure 20. This assembly was the same as the straight mixing stack with ports and two-ring diffusor except



that a shroud was placed around the portion of the mixing stack that was ported. This forced the air drawn in by the ports to flow between the shroud and the outside surface of the mixing stack. Spacers, designed to minimize flow blockage, held the shroud a uniform distance from the mixing stack. Pressure taps were located along the mixing stack as shown in Figure 20.

G. ALIGNMENT

The alignment of the mixing stack with the primary air flow nozzles was accomplished using cross-hairs, a level, and a 30.48 cm (12 in) rule graduated in 0.25 mm (0.01 in). The cross-hairs were placed across the exit and entrance planes of the mixing stack, locating the geometric centerline axis of the mixing stack. By using these cross-hairs and the level, the geometric centerline of the mixing stack was aligned with a machining mark that represented the geometric center of the four primary nozzles. The graduated scale was used to establish the desired stand-off distance (S/D) and insure that the exit plane of the primary nozzles and the entrance plane of the mixing stack were parallel. The three axis mixing stack mounting stand, illustrated in Figure 30 and pictured in Figure 31, allowed alignment adjustments to be performed easily and accurately.



IV. EXPERIMENTAL METHOD

Evaluation of the eductor model requires the experimental determination of pressure differentials across the ASME long radius flow nozzles, temperatures of primary and induced air flows, internal mixing stack pressures, and mixing stack exit velocities. These experimentally determined quantities are then correlated and analyzed to obtain pumping coefficients, induced air flow rates, pressure distributions within the mixing stack, mixing stack exit velocity profiles, and momentum correction factors. The qualities of the eductor model are then evaluated to determine the model's relative effectiveness.

The following discussion addresses the individual qualities of the eductor model and how they were determined.

A. PUMPING COEFFICIENTS

The secondary pumping coefficient and the tertiary pumping coefficient provide the basis for analysis of the eductor model's pumping performance. Thus, changes in eductor model parameters which affect pumping can be noted by a change in pumping coefficient. The pumping coefficient(s) is desired at the operating point which is simulated by completely opening the air plenum(s) to the environment. This can not be conveniently measured. Therefore, the eductor's characteristics are determined, plotted, and then extrapolated to the operating point.



The pumping characteristics of the eductor model are established by varying the associated induced air flow rate, either secondary or tertiary, from zero to its maximum measurable rate. This rate is determined by sequentially opening the ASME flow nozzles mounted in the appropriate plenum and recording the pressure drop across the nozzles. Values for nozzle cross sectional area, pressure drop, and induced air temperature are then used to calculate the dimensionless parameters $\Delta P^*/T^*$ and $W^*T^*^{0.44}$ or $\Delta PT^*/TT^*$ and $\Delta W^*T^*^{0.44}$ as described earlier in the Theory and Analysis section. The dimensionless parameters are then plotted as illustrated in Figure 36. Extrapolation of the pumping characteristics curve to intersect with the zero pressure/temperature coefficient abscissa locates the appropriate operating point coefficient of the model.

B. FILM COOLING PUMPING COEFFICIENT

The film cooling pumping coefficient WF*TF*^{0.44} could not be obtained in a manner similar to the secondary and tertiary pumping coefficients because the testing facility did not allow space for a dedicated film cooling air plenum. (The straight ported stack geometry is the only exception, where the film cooling pumping coefficient was calculated using the tertiary air plenum as a dedicated film cooling air plenum.) Therefore, the film cooling was combined with either the secondary or tertiary air flows as required by the eductor model geometry. The film cooling pumping coefficient was



then calculated as the difference in the secondary and tertiary pumping coefficients with and without the addition of film cooling.

C. INDUCED AIR FLOWS

Three induced air flows are identified in this study: secondary, tertiary, and film cooling.

The secondary air flow indicates the amount of induced air passing through the secondary air plenum.

The tertiary air flow indicates the amount of induced air passing through the tertiary air plenum. The dimension-less quantity WT* is the ratio of the tertiary air flow rate to the primary air flow rate.

The film cooling air flow is that flow which is induced through the mixing stack ports or shroud. It is introduced as a coolant to reduce heat transfer in two areas: between the hot exhaust gases within the mixing stack and the interior wall of the mixing stack; and when a shroud is being used, between the exterior mixing stack wall and the interior wall of the shroud. The dimensionless quantity WF* is the ratio of the film cooling air flow rate to the primary air flow rate. Due to test facility limitations, film cooling air flow was included in either secondary or tertiary air flows depending on model geometry.

D. PRESSURE DISTRIBUTIONS

The mixing stack axial static pressure was obtained using a series of pressure taps fixed to the mixing stack. These



taps were generally placed in two axial rows, the rows being 45 degrees apart radially. Along each row the taps were spaced in increments of quarter diameters. The exact location of the pressure taps is indicated on the figure of each mixing stack geometry tested. The mixing stack was aligned such that one row of pressure taps was axially in line with one of the four primary nozzles. The row position relative to the primary nozzles was labelled as illustrated in Figure 37. The stack pressure (PMS) is plotted versus X/D to obtain a mixing stack pressure distribution for each geometry tested.

E. VELOCITY PROFILES AND MOMENTUM CORRECTION FACTOR

The momentum correction factor K_m is a measure of the completeness of mixing and provides the basis for evaluating this aspect of eductor performance. The momentum correction factor is evaluated at the exit of the mixing stack by means of two velocity traverses and the definition given in equation (4). Velocity profiles at the mixing stack exit were calculated from the pressures measured using the pitot tube pictured in Figure 35. Since it was impractical to obtain a complete three-dimensional plot of velocities at the exit plane of the mixing stack, advantage was taken of the symmetry of the velocity surface resulting from the arrangement of the primary nozzles. Only two traverses were made. The first traverse passes directly over the primary nozzles and records the peak velocities, while the second traverse passes between the



nozzles, thus measuring the minimum velocities at the mixing stack exit. Figure 36 illustrates the orientation and identification of the two velocity traverses. An average velocity at the mixing stack is obtained by integrating the velocity distribution over the mixing stack area to obtain an integrated volumetric flow rate which, when divided by the mixing stack cross sectional area, yields the average velocity.



V. DISCUSSION OF EXPERIMENTAL RESULTS

Exhaust eductor systems designed for marine gas turbine applications must substantially cool exhaust gases, present an exterior stack surface temperature which will not give an easily detectable infrared signature, and effectively disburse exhaust gases. In order to evaluate the overall eductor model performance in this study, four areas of performance were identified: the amount of secondary air flow induced by the primary air flow, referred to here as pumping; the degree of mixing of primary and induced air flows within the mixing stack system, referred to here as mixing; the amount of uptake back pressure impressed upon the turbine exhaust by the eductor system; and the amount of film cooling air available to reduce the exterior stack temperature of the eductor system.

The eductor models in this study were designed to reduce the high back pressure 22.1 cm $\rm H_2O$ (8.7 in $\rm H_2O$) in the model previously tested by Moss [2] and to introduce various mixing stack geometries to minimize the exterior stack temperatures and still provide good secondary air flows and mixing.

A. QUANTITATIVE MEASUREMENTS

Quantitative measurement of the four areas of performance was required to evaluate the different eductor models. A summary of all eductor system models tested in this study is



given in Tables I and II. Data on individual models is located in the tables referenced in the description of each model. The pumping, mixing, back pressure, and film cooling qualities of the eductor model were evaluated in the following manner.

1. Pumping

The values of the secondary and tertiary pumping coefficients were used, as required by the model geometry being tested, to evaluate the pumping abilities of the models. Values for the pumping coefficients were obtained from plots of experimental data using the correlations

$$\frac{\Delta P^*}{T^*} = \phi(W^*T^{*0.44})$$

for the secondary pumping coefficient, and

$$\frac{\Delta PT^*}{TT^*} = \phi (WT^*TT^*^{0.44})$$

for the tertiary pumping coefficient. Tabulated values of the pumping coefficients for the eductor model configurations tested are included in Table II.

2. Mixing

Design changes to the mixing stack exit geometries made quantification of the model mixing quality more complex than it had been in the studies of Ellin and Moss. For ease of cross referencing with the previous studies, the momentum correction factor $K_{\rm m}$ was calculated and tabulated in Table II



for all model geometries tested which were of the straight mixing stack design. In those cases, the closer the momentum correction factor is to unity, the more complete the mixing of the primary and induced air flows.

With the introduction of other than straight mixing stack exit geometries, a quantitative evaluation of mixing was made by comparison of the ratio of the peak exit velocity to the average primary nozzle velocity. This non-dimensional quantity, which is tabulated in Tables XIV to XIX, was evaluated for each velocity traverse oriented in the A and B direction, as shown in Figure 36. The lower the maximum values of this ratio are, the more complete the mixing.

Figure 42 contains plots of all the velocity profiles made on the models of this study. For reference purposes, this figure also contains the numbers of the tables from which the data was obtained.

3. Uptake Back Pressure

The static uptake back pressure PU-PA was a value directly recorded from experimental data. To optimize turbine efficiency, this value should be kept as low as practical and still maintain an effective exhaust eductor system. Tabulated values of static uptake back pressure are in Table II.

4. Film Cooling

The value of the film cooling pumping coefficient WF*TF*^{0.44} is determined as described in the experimental method section. The values of the film cooling pumping



coefficient are proportional to the film cooling air flow rate and indicate how well the eductor system is inducing film cooling air.

B. SYSTEM EVALUATION

Initial model testing was conducted using an eductor model with a straight mixing stack length L/D of 3.0 and a stand off distance S/D of 0.5. The results of these tests are shown in Tables IV and XIV and Figures 40(a) through 38(c), 41(a) through 41(c) and 42(a). These results compared favorably with the experimental results Moss obtained using a similar geometry; see Figure 40(c).

An L/D ratio of 2.5 was selected for use as the standard length in this study because it is representative of the length found on a marine gas turbine installation.

The results of testing the L/D ratio of 2.5 are shown in Tables IV and XIV, and Figures 40(d), 41(d), and 42(b). The relatively high uptake back pressure of 22.1 cm $\rm H_2O$ (8.7 in $\rm H_2O$) was considered unsatisfactory in terms of decreased turbine efficiency. Thus, a change in primary nozzle diameter was made. An increase in primary nozzle diameter from 8.59 cm (3.38 in) to 9.40 cm (3.70 in) reduced the mixing stack area to primary nozzle area ratio $\rm A_m/\rm A_p$ from 3.0 to 2.5. The results of utilizing the larger primary flow nozzles with a straight mixing stack with an L/D ratio of 2.5 are shown in Tables V and XV, Figures 40(e), 40(f), 41(e), and 42(c). The uptake back pressure was reduced significantly to 14.7 cm $\rm H_2O$



(5.8 in $\rm H_2O$) as desired. However, the secondary pumping coefficient was reduced from 0.80 to 0.60, and the momentum correction factor increased from 1.027 to 1.038. The undesirable effects of reduced pumping and reduced mixing when changing to an $\rm A_m/\rm A_p$ ratio of 2.5 required investigation of mixing stack exit geometries which would increase eductor pumping and mixing characteristics without causing excessive increases in uptake back pressure.

The first mixing stack exit geometry modification attempted was that of a solid diffusor with a seven degree double included angle, dimensionally illustrated in Figure 10 and pictured in Figure 11. The diffusor was selected because the increase in mixing stack area at the diffusor decreases the mixing stack pressure relative to the same L/D position on the straight mixing stack. This pressure reduction was reflected upstream at the mixing stack entrance and at the primary flow nozzles where a lower back pressure and an increased secondary pumping coefficient was noted.

At this point in the study due to mixing stack exit geometry changes, the use of the momentum factor is no longer a valid measure of mixing. In its place the peak exit velocity to the average primary nozzle velocity, referred to here as the velocity ratio, was utilized exclusively for determination of mixing quality. The results of testing the solid diffusor are shown in Tables VI and XVI, and Figures 40(h) through 40(m), 41(g) through 41(l) and 42(e) through 42(k). Relative



to the straight mixing stack, the mixing stack with solid diffusor had a slightly decreased uptake back pressure [from 14.7 cm H₂O (5.8 in H₂O) to 14.5 cm H₂O (5.7 in H₂O)], a velocity ratio which showed no effective change, and a significant increase in the secondary pumping coefficient from 0.58 to 0.70.

At this point in the study a major design development was implemented with the purpose of cooling the exterior surface of the stack to reduce the infrared signature. The first design was that of a split ring diffusor, schematically represented in Figure 4. The split ring design was selected because the ambient air induced through the rings by the flow of hot exhaust gases, referred to here as tertiary air flow, surrounds the diffusor ring and acts as a thermal coolant. This reduces the heat transferred from the hot exit gases to the interior walls of the diffusor ring, thus reducing the exterior temperature of the upper portion of the stack. Since only the principle of the ring diffusor was to be investigated, and it was not the intent of this study to develop an optimal design, only two split ring diffusor configurations were modeled and tested.

The two-ring diffusor, pictured in Figure 13 and dimensionally illustrated in Figure 12, was modeled first. The results of these tests are shown in Tables VII and XVI, and Figures 40(n), 41(m), and 42(i). Relative to the mixing stack with a solid diffusor, the mixing stack with the two-ring



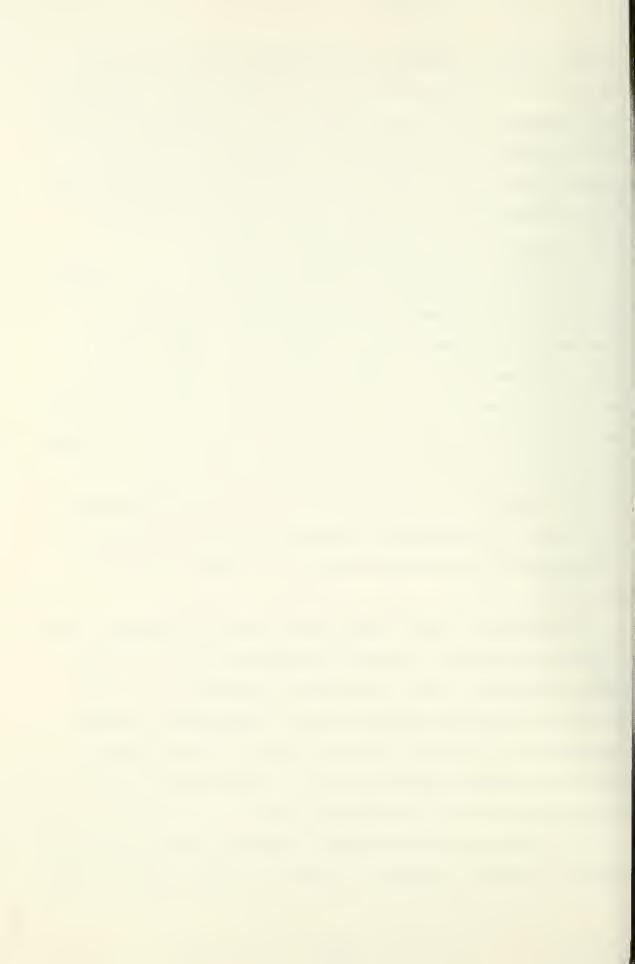
duffusor had an increase in uptake back pressure from 14.5 cm $\rm H_2O$ (5.7 in $\rm H_2O$) to 15.4 cm $\rm H_2O$ (6.05 in $\rm H_2O$), a velocity ratio decrease from 0.86 to 0.80 in the A direction and from 0.71 to 0.69 in the B direction, a decrease in secondary pumping coefficient from 0.70 to 0.62 (still better than the 0.58 recorded for the straight stack with an L/D of 2.5), and a tertiary pumping coefficient of 0.115.

The three-ring diffusor was then modeled. It is pictured in Figure 15 and dimensionally illustrated in Figure 14.

The results of these tests are tabulated in Tables VIII and XVI, and Figures 40(o), 41(n), and 42(j). Overall eductor performance was less than that found in the two-ring diffusor design with back pressure very nearly the same at 15.2 cm H₂O (6.0 in H₂O), a velocity ratio increase from 0.80 to 0.84 in the A direction and from 0.69 to 0.71 in the B direction, no change in the secondary pumping coefficient of 0.62, and a decrease in the tertiary pumping coefficient from 0.115 to 0.098.

The decrease noted in the overall eductor performance when comparing results of the three-ring diffusor to that of the two-ring diffusor may be misleading. Construction of the three-ring diffusor with the material thicknesses selected increased the blockage of tertiary air flow significantly. Therefore, based on these results, no direct comparison of the two designs can be considered final.

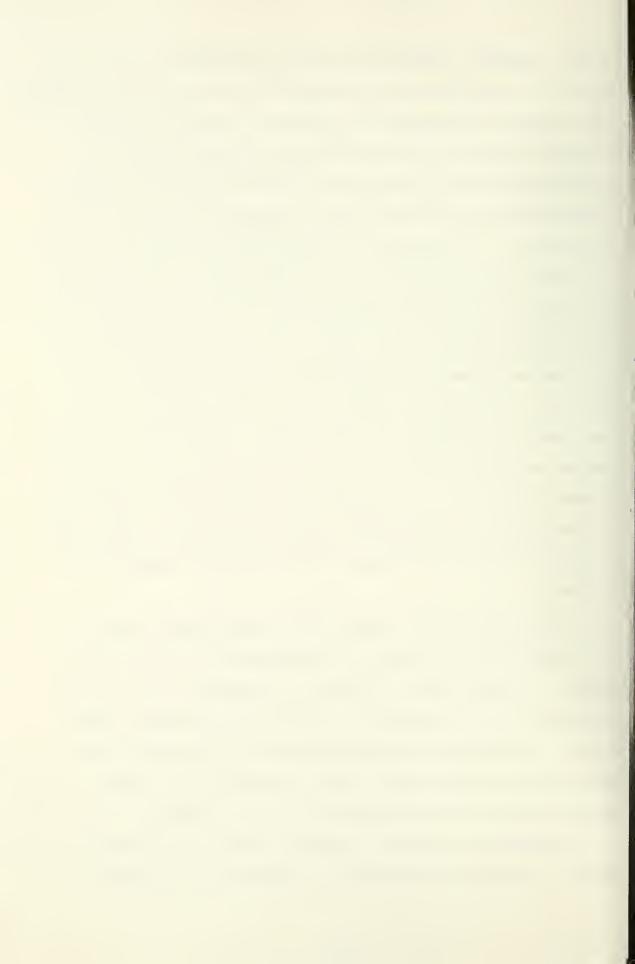
The tertiary air flow induced through the diffusor rings appears to offer a method of cooling the upper portion of the



However, additional cooling is required on the lower stack. portion. To deal with this problem, the use of induced ambient air was again investigated. Ambient air induced into the straight portion of the mixing stack for the purpose of convectively cooling the interior wall of the mixing stack heated by the hot exhaust gases is referred to here as film cooling air. To determine if the pressure potential necessary to induce film cooling air was available, the axial pressure distribution in the straight portion of the mixing stack with the two-ring diffusor was closely examined. This examination included experimentally obtaining the axial pressure distributions at intervals of 0.125 D along the mixing stack at four radial locations around the stack. The pressure distribution as affected by misalignment of the mixing stack to the primary nozzles was also examined by deliberate misalignment of the stack as schematically shown in Figure 39. The results of these tests are tabulated in Table III and summarized as follows.

The internal mixing stack axial pressure distribution is not significantly affected by misalignments of up to 3.42 degrees. Mixing stack pressure is independent of the radial position after a distance of 0.125 D from the mixing stack inlet. The pressure differential between the ambient air and that within the mixing stack is sufficient to induce ambient air into the mixing stack as film cooling.

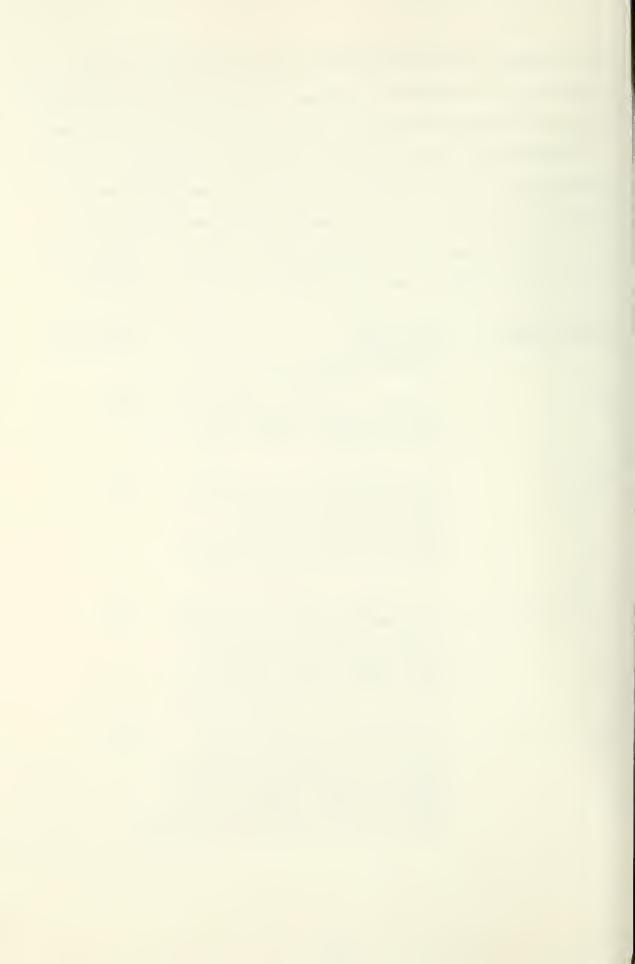
To examine the effects of film cooling on the eductor system, the straight mixing stack geometry was utilized.



This geometry had the advantages of much previous testing, relative ease of assembly, and use of the existing air plenum within the testing facility to measure film cooling air flow.

The straight stack with ports pictured in Figure 17 and dimensionally illustrated in Figure 16 was manufactured as previously described in the Experimental Apparatus Section. The configurations of the ported mixing stack are defined as follows with tabular results listed in Table IX and XVII.

Configuration	<u>Definition</u>	Table No.
	(See Figure 16 for location of Positions A, B, C, D)	
A-1	One port on each rectangular insert located axially at position A was open (a total of four ports)	IXb
A-1, B-1	In addition to the A-l ports already opened, one port on each rectangular insert located axially at position B was opened (four additional ports, a total of eight ports open in this configuration)	IXc
A-1, B-1, C-2	In addition to the A-1 and B-1 ports already open, two ports on each rectangular insert located axially at position C were opened (eight additional ports opened for a total of sixteen in this configuration)	IXd
A-1, B-1, C-2, D-2	In addition to the A-1, B-1, and C-2 ports already open, two ports on each rectangular insert located axially at position D were opened (eight additional ports opened for a total of 24 in this configuration	IXe



As compared to the straight mixing stack, the ported mixing stack in the A-1, B-1, C-2, D-2 configuration had an increased uptake back pressure from 14.7 cm $\rm H_2^{\circ}O$ (5.8 in $\rm H_2^{\circ}O$) to 15.2 cm $\rm H_2^{\circ}O$ (6.0 in $\rm H_2^{\circ}O$), a velocity ratio reduction from 0.85 to 0.79 in the A direction, a velocity ratio increase from 0.72 to 0.76 in the B direction, and a film cooling pumping coefficient of 0.078. The secondary pumping coefficient was not measured for this configuration, it was estimated to be 0.58 from the results of the tests run on the ported stack in the fully closed position.

The ported mixing stack was then shortened to an L/D ratio of 1.75 and the two-ring diffusor tested earlier was added. The ported mixing stack with two-ring diffusor is pictured in Figure 19 and dimensionally illustrated in Figure 18. The results of the tests on this model are shown in Tables X and XVIII, and Figures 40(u) through 40(w), 41(t) through 41(v) and 42(l). The addition of the two-ring diffusor had many of the same effects on the straight ported mixing stack as it had on the straight mixing stack. The secondary pumping coefficient was 0.57, showing no appreciable change from the estimated 0.58 for the ported stack, the tertiary pumping coefficient remained the same at 0.11 and the film cooling pumping coefficient showed very little change, decreasing from 0.078 in the ported stack model to 0.076 in the ported stack with two-ring diffusor. The uptake back pressure remained constant at 15.2 cm H_2O (6.0 in H_2O) and the velocity ratio increased from 0.79 to 0.84 in the A



direction and decreased from 0.76 to 0.72 in the B direction. These results indicate that this configuration was capable of pumping sufficient quantities of tertiary and film cooling air and could have a significant effect on the external temperature of the mixing stack system.

Infrared radiation from the mixing stack system could be reduced by thermally shielding the system. This concept is used by employing a shrouded mixing stack system. This system is schematically represented in Figure 5. Film cooling air induced by the mixing stack ports was directed between the exterior of the mixing stack and the interior of the shroud. Thus the shroud is insulated from the hot exterior of the mixing stack by the flow of film cooling air and acts as a heat shield for the hot mixing stack.

Initial testing of the shrouded, ported, mixing stack with two-ring diffusor indicated that the entrance area, which was restricted due to the entrance transition material of the straight mixing stack, was a choke point for the film cooling air flow. This condition was remedied by starting the shroud 1.1 cm (0.5 in) away from the mixing stack entrance. The model is pictured in Figure 21 and dimensionally illustrated in Figure 20. Results of the first shrouded mixing stack tested are shown in Tables XI and XIX, and Figures 40(x) through 40(aa), 41(w) through 41(z), and 42(m). Results of the mixing stack tested with the shortened shroud are shown in Tables XII and XIX, and Figures 40(bb) through 40(ee),



41(aa), and 42(n). The film cooling air coefficient was favorably affected with the shortening of the shroud, and in both models tested the film cooling air coefficient was greater than it had been for the mixing stack system without the shroud (this may be only due to experimental data scatter, however the purpose of the model test was to insure that film cooling air flow would remain adequate when the shroud was added).

To further enhance the air flow through the shroud, the shroud was modified to extend open ended along the mixing stack and merge with the first ring of the two-ring diffusor. system configuration is referred to as the flow-through shroud with diffusor ring mixing stack. It is pictured in Figure 22. The results of testing this configuration are shown in Tables XIII and XIX, and Figures 40(ff) through 40(ii), 41(bb), and 42(o). The results indicate that the film cooling air pumping coefficient increased almost as much as the tertiary air pumping coefficient decreased when compared to the results obtained from the ported stack with the two-ring diffusor and shroud. No direct measurement of the quantity of film cooling air entering the mixing stack was attempted, however, the pressure distribution along the mixing stack is very similar to that recorded for the ported stack with the two-ring diffusor, Figure 41(a), so that film cooling air flow can be assumed to be similar.



VI. CONCLUSIONS

This investigation studied the effects on the eductor system's overall performance of varying the geometric configuration of the mixing stack and changing the area of the primary flow nozzles. A detailed description of the various eductor systems modeled and tested is given in the experimental apparatus section. Trends and interdependency between geometries tested were discussed in detail in the experimental results section. Only a summary of the conclusions resulting from this investigation are given here.

- A. Changing the ratio of the area of the mixing stack to the area of the primary flow nozzles from 3.0 to 2.5 decreased the uptake back pressure and reduced the secondary pumping coefficient.
- B. An improvement in secondary pumping and a decrease in uptake back pressure was obtained when a solid diffusor was placed on the exhaust end of the mixing stack.
- C. The combination of two-ring diffusor (geometry) induced more tertiary flow than the three-ring diffusor (geometry).
- D. The ported mixing stack provided significant air flow through the ports which could provide film cooling on the inside of the mixing stack.
- E. The ported mixing stack and two-ring diffusor provided increased system performance without affecting the back pressure in the uptakes.



- F. The shroud placed around the mixing stack did not degrade pumping or mixing characteristics of the eductor system, yet it directs the film cooling air flow between the shroud and the outside surface of the mixing stack and provides thermal shielding of the mixing stack.
- G. The combination of the ported mixing stack with flowthrough shroud and diffusor provided the optimum results
 of the geometries tested. This configuration had the
 features of providing film cooling where it could be
 most effective, good secondary air flow and good mixing.



VII. RECOMMENDATIONS

In addition to providing insight into the effects that geometric parameters have on eductor system parameters, this research has also generated an awareness of the investigation's shortcomings. Presented here are recommendations for future research and suggestions for different eductor system design.

- A. Test the following eductor systems in a model testing facility using a hot gas for the primary air flow: a mixing stack with two-ring diffusor, a straight ported mixing stack, and a ported mixing stack with a shroud and two-ring diffusor. Evaluate the system performances by placing thermocouples on the system and correlating these results with the cold flow data contained herein.
- B. With temperature and pressure distribution data obtained from tests conducted using hot gas as the primary air flow, investigate the optimum placement of cooling ports to achieve a minimum mixing stack surface temperature. Starting the first set of film cooling ports and shroud a significant distance down the mixing stack may prove beneficial.
- C. Using the cold flow testing facility, investigate the optimum split ring diffusor included angle (ψ) as shown in Figure 4.



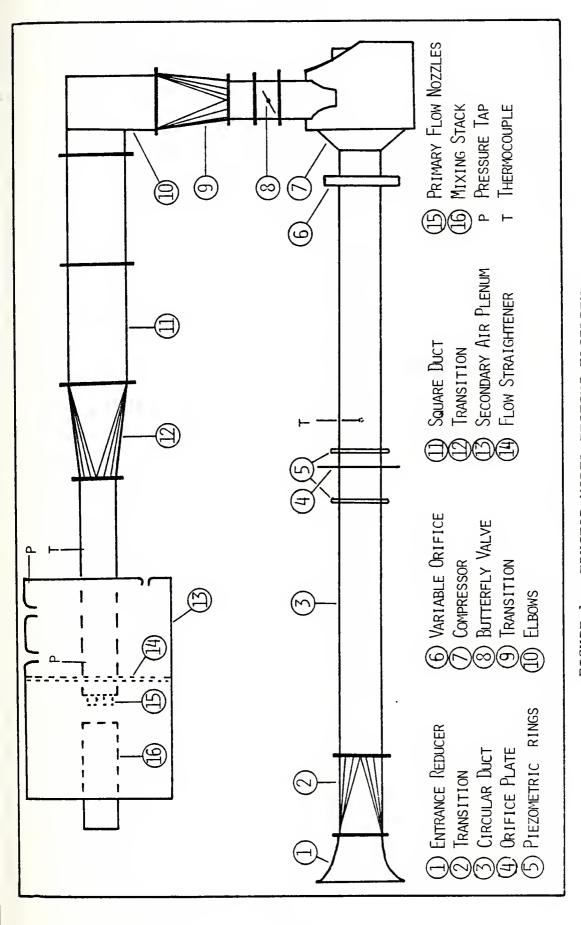
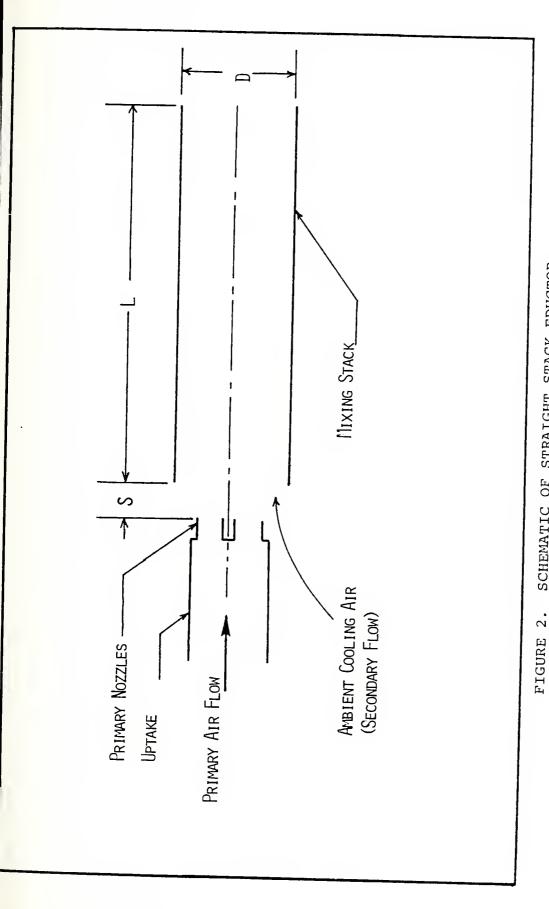


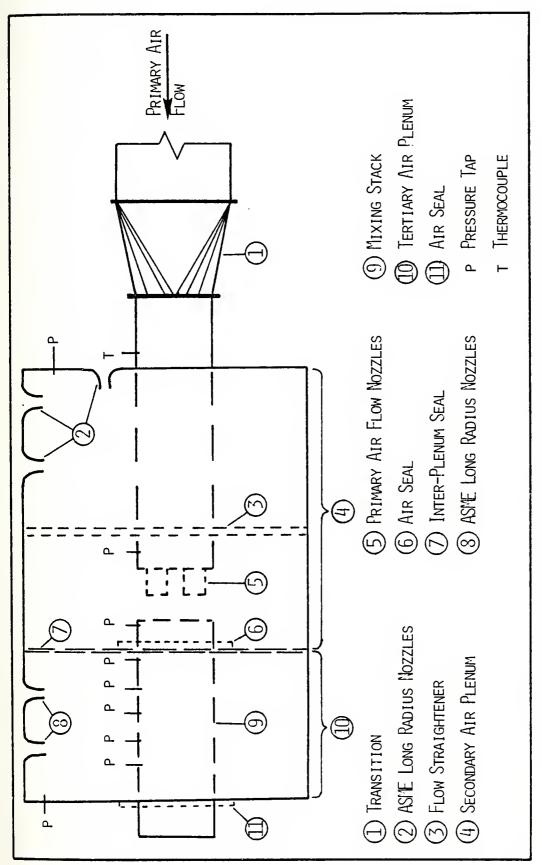
FIGURE 1. EDUCTOR MODEL TESTING FACILITY



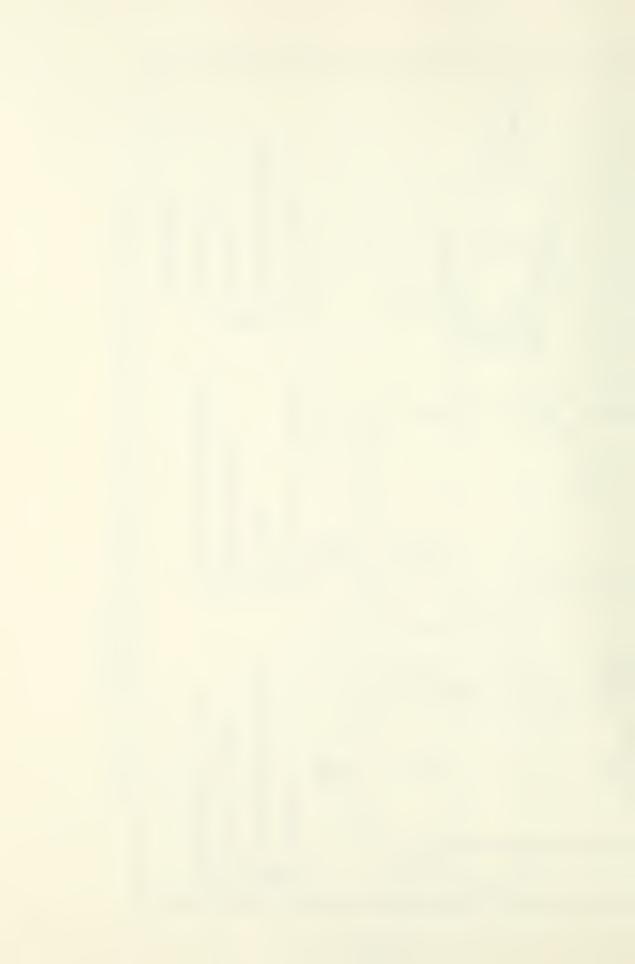


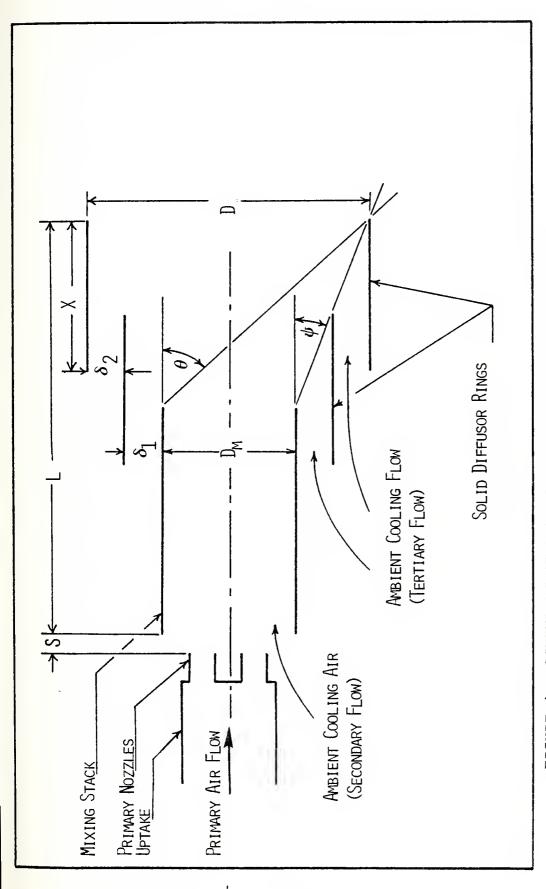
SCHEMATIC OF STRAIGHT STACK EDUCTOR





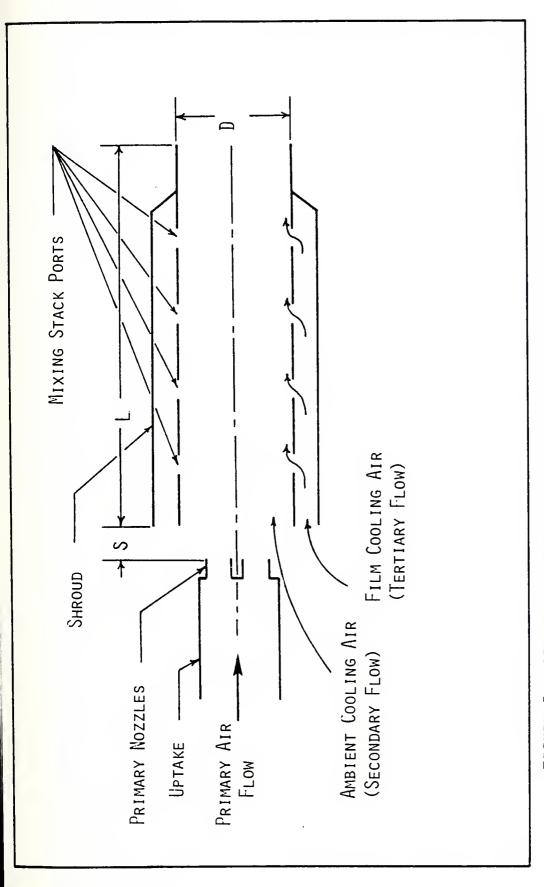
EDUCTOR MODEL TESTING FACILITY, SECONDARY AND TERTIARY AIR PLENUMS FIGURE 3.



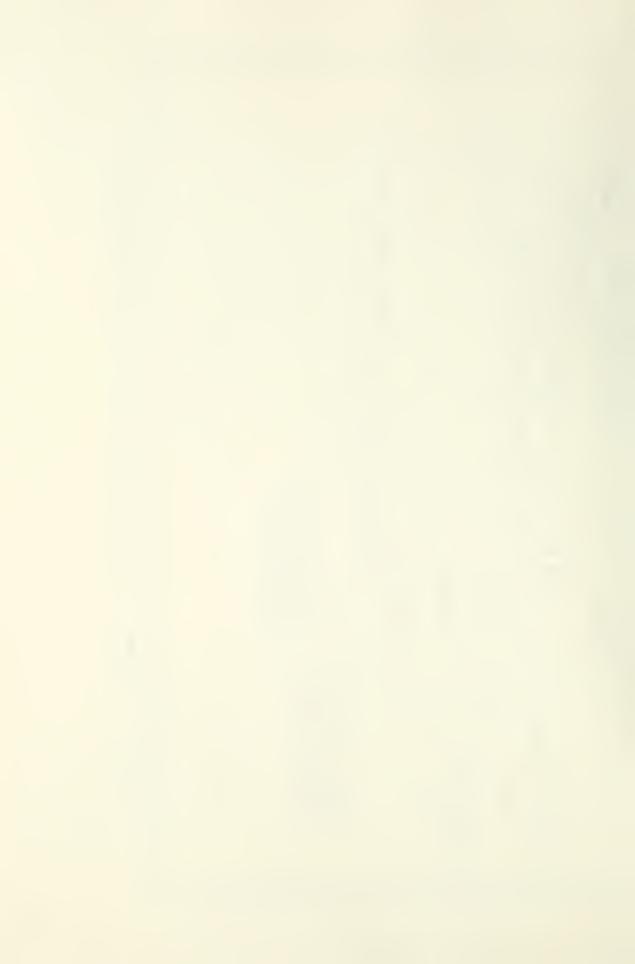


SCHEMATIC OF MIXING STACK WITH DIFFUSOR RINGS FIGURE 4.





SCHEMATIC OF SHROUDED MIXING STACK WITH FILM COOLING PORTS FIGURE 5.



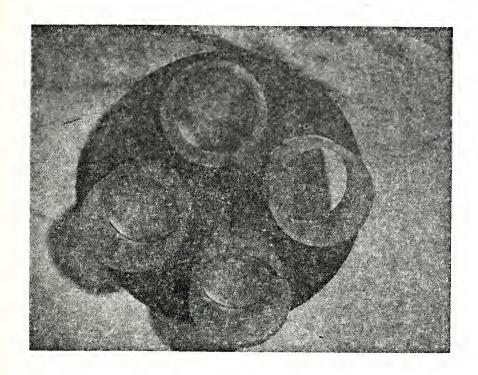
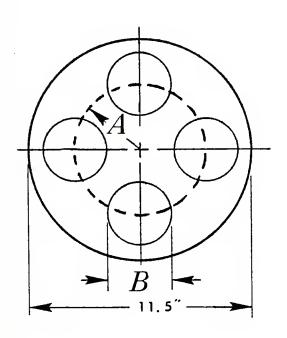


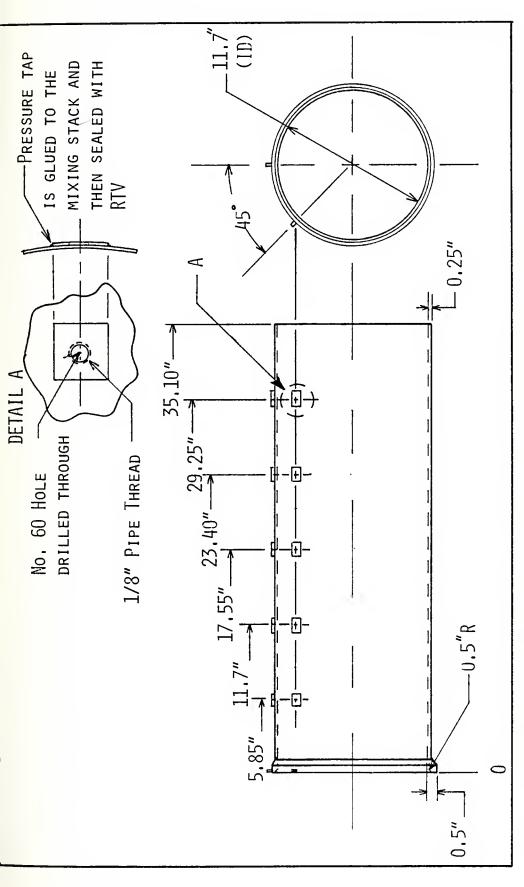
FIGURE 6. PRIMARY FLOW NOZZLES USED IN THIS STUDY



AREA RATIO	A	В
3.0	3.40"	3.38"
2.5	3.20"	3.70"

FIGURE 7. LAYOUT OF PRIMARY FLOW NOZZLES



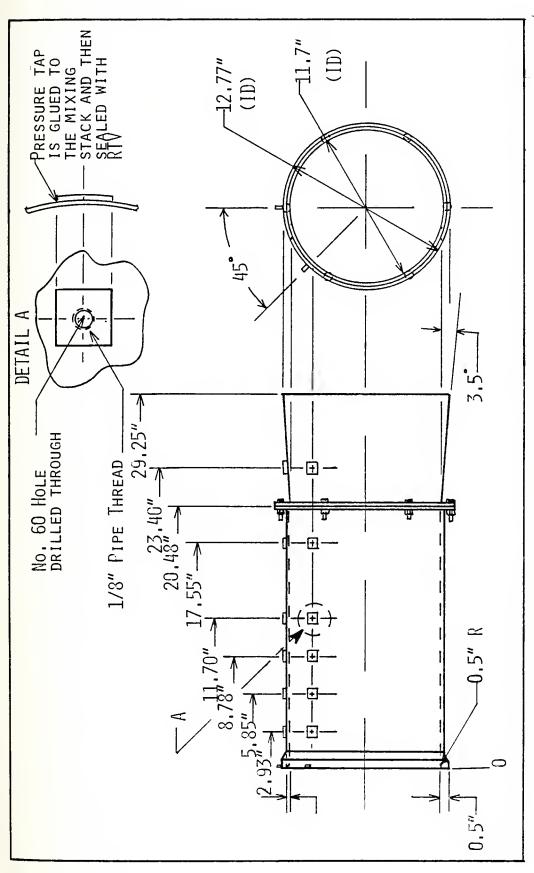


DIMENSIONAL ILLUSTRATION OF STRAIGHT MIXING STACK FIGURE 8.



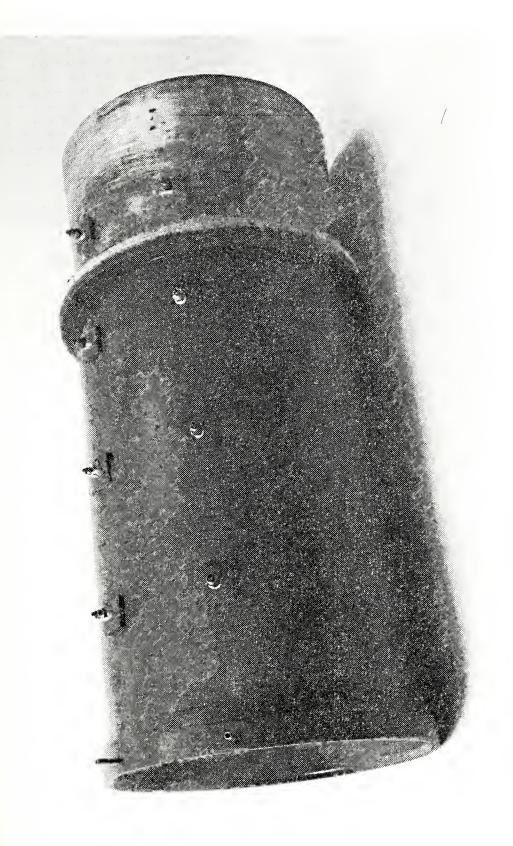
FIGURE 9. STRAIGHT MIXING STACK





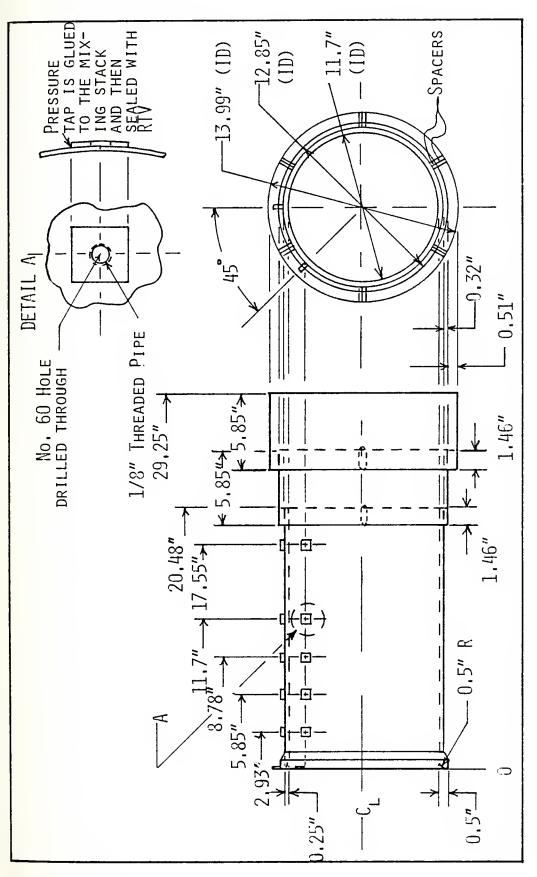
DIMENSIONAL ILLUSTRATION OF MIXING STACK WITH SEVEN DEGREE DOUBLE INCLUDED ANGLE SOLID DIFFUSOR FIGURE 10.





MIXING STACK WITH SEVEN DEGREE DOUBLE INCLUDED ANGLE SOLID DIFFUSOR FIGURE 11.



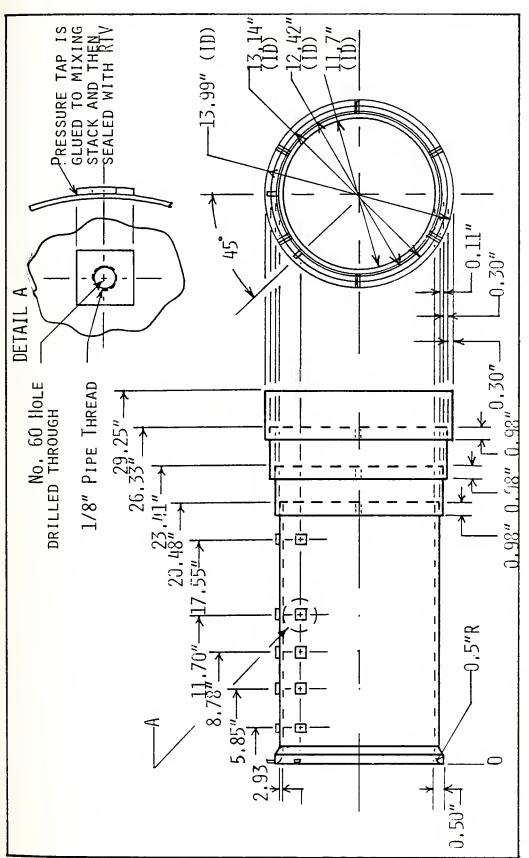


DIMENSIONAL ILLUSTRATION OF MIXING STACK WITH TWO-RING DIFFUSOR FIGURE 12.

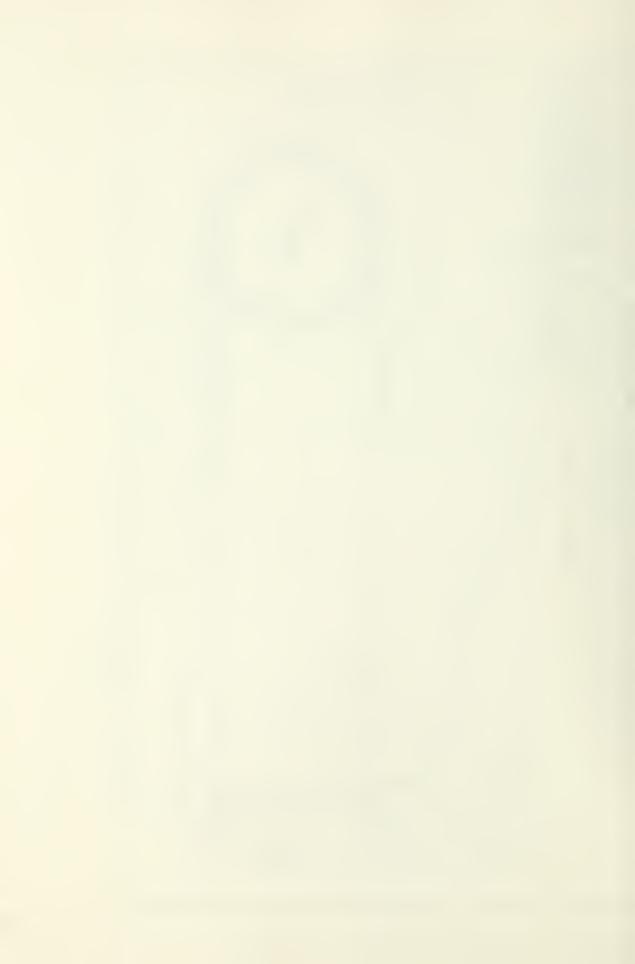


FIGURE 13. MIXING STACK WITH TWO-RING DIFFUSOR





DIMENSIONAL ILLUSTRATION OF MIXING STACK WITH THREE-RING DIFFUSOR FIGURE 14.



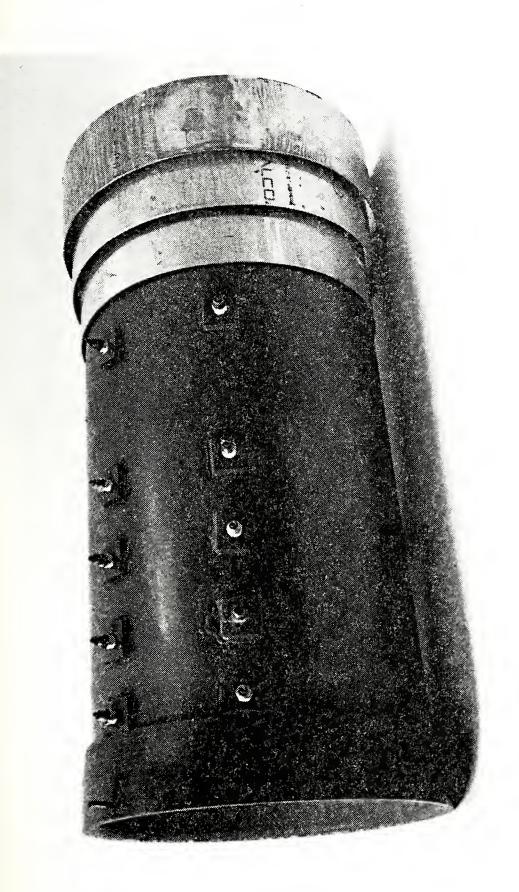
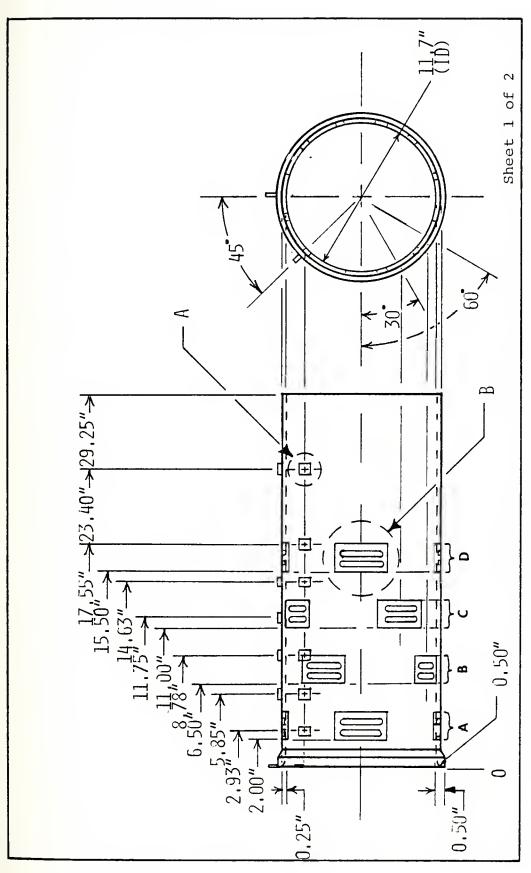


FIGURE 15. MIXING STACK WITH THREE-RING DIFFUSOR





DIMENSIONAL ILLUSTRATION OF STRAIGHT MIXING STACK WITH PORTS FIGURE 16.



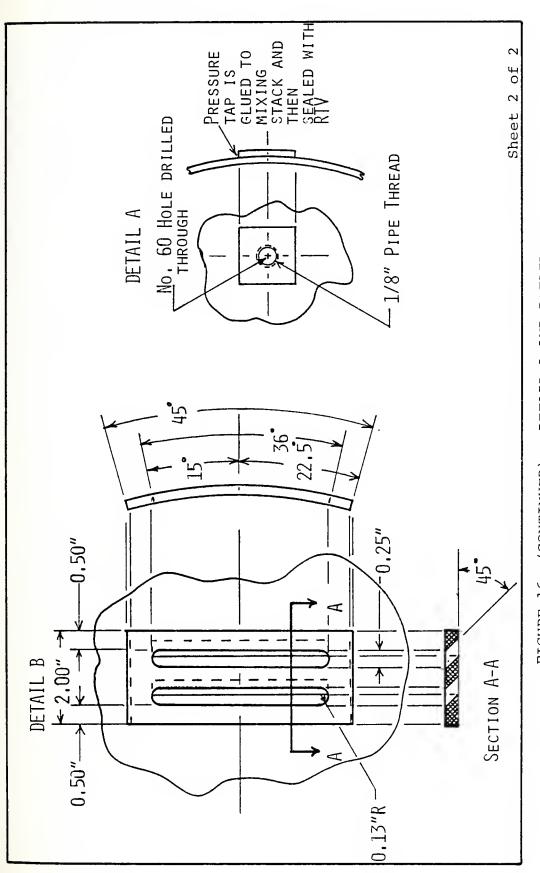


FIGURE 16 (CONTINUED) DETAIL A AND DETAIL B



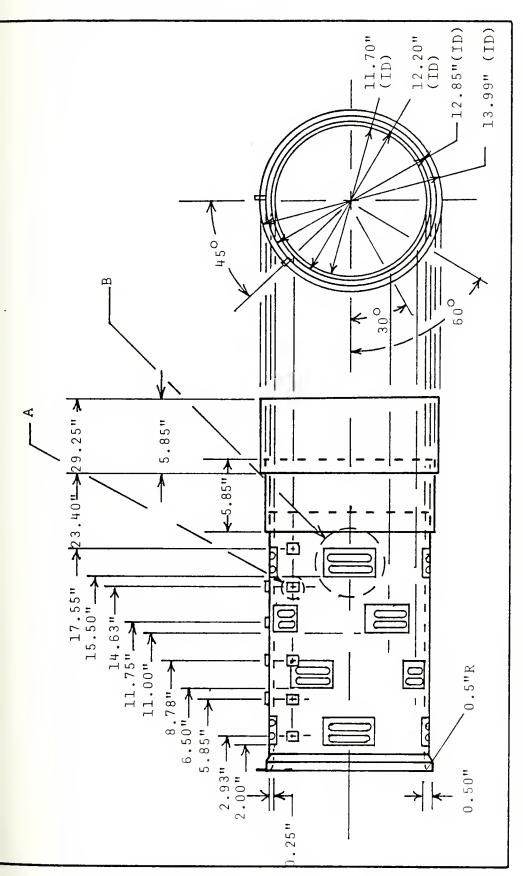
FIGURE 17. STRAIGHT MIXING STACK WITH PORTS





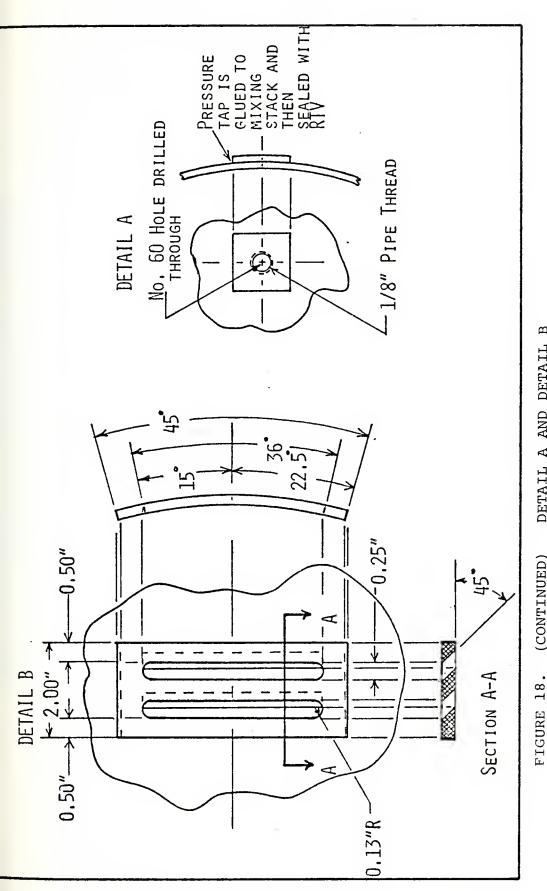
FIGURE 17 (CONTINUED) REMOVABLE PORTED INSERT





DIMENSIONAL ILLUSTRATION OF PORTED MIXING STACK AND A TWO-RING DIFFUSOR FIGURE 18.





DETAIL A AND DETAIL B (CONTINUED)



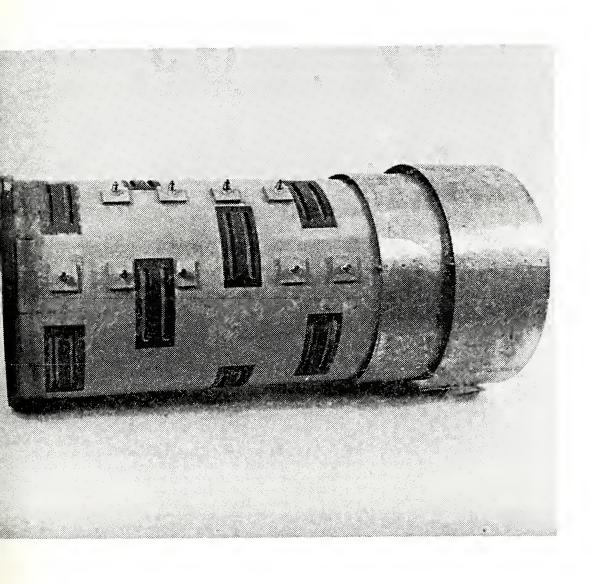


FIGURE 19. PORTED MIXING STACK AND A TWO-RING DIFFUSOR



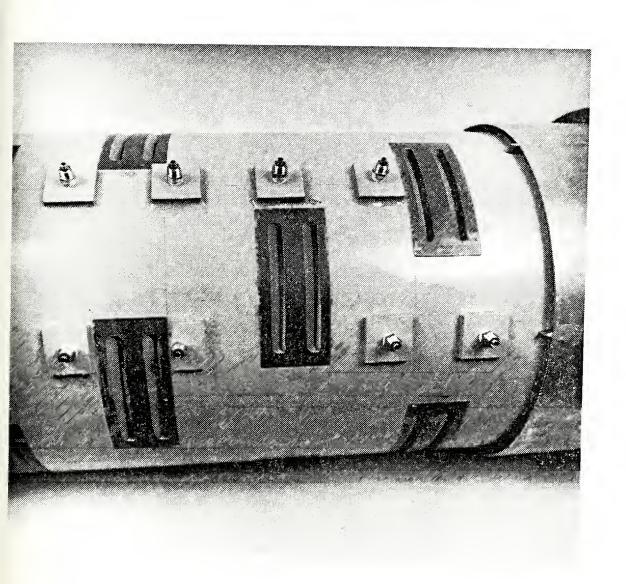
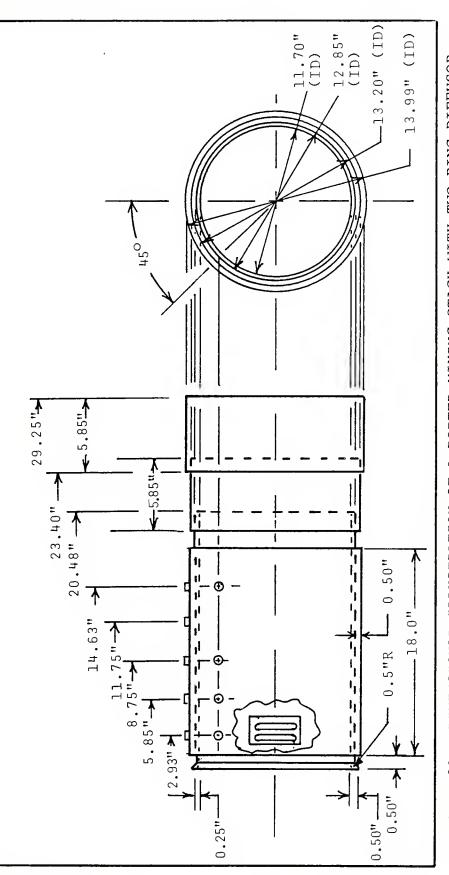


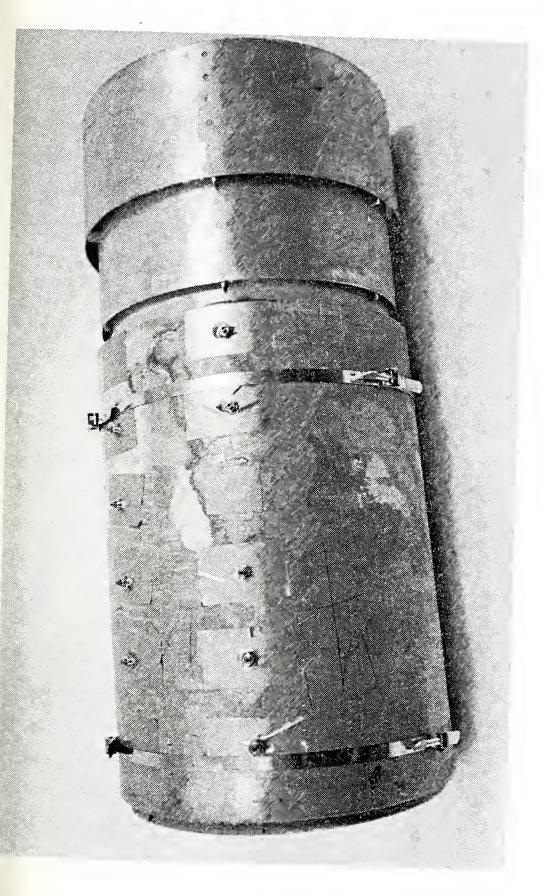
FIGURE 19. (CONTINUED) DETAILED VIEW OF PORTED INSERT AND PRESSURE TAP ARRANGEMENT





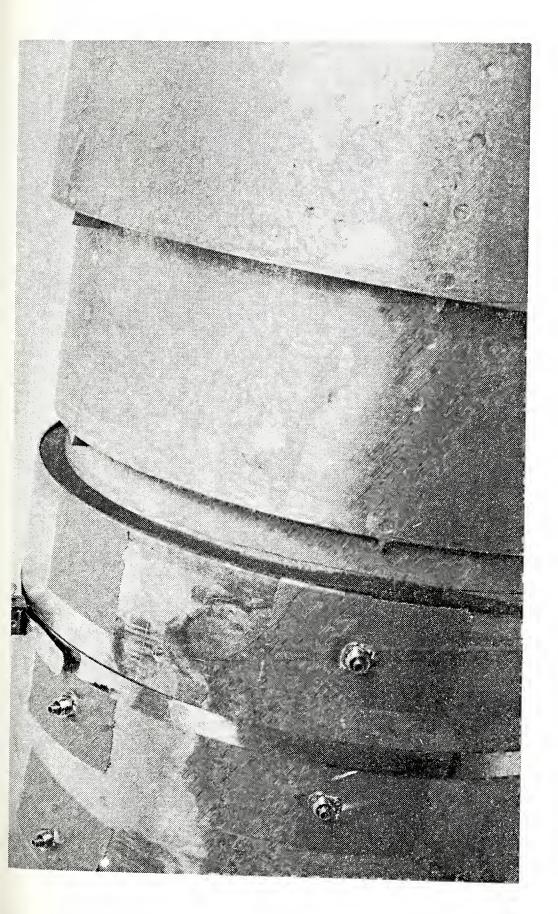
DIMENSIONAL ILLUSTRATION OF A PORTED MIXING STACK WITH TWO-RING DIFFUSOR AND SHROUD FIGURE 20.





PORTED MIXING STACK WITH TWO-RING DIFFUSOR AND SHROUD FIGURE 21.

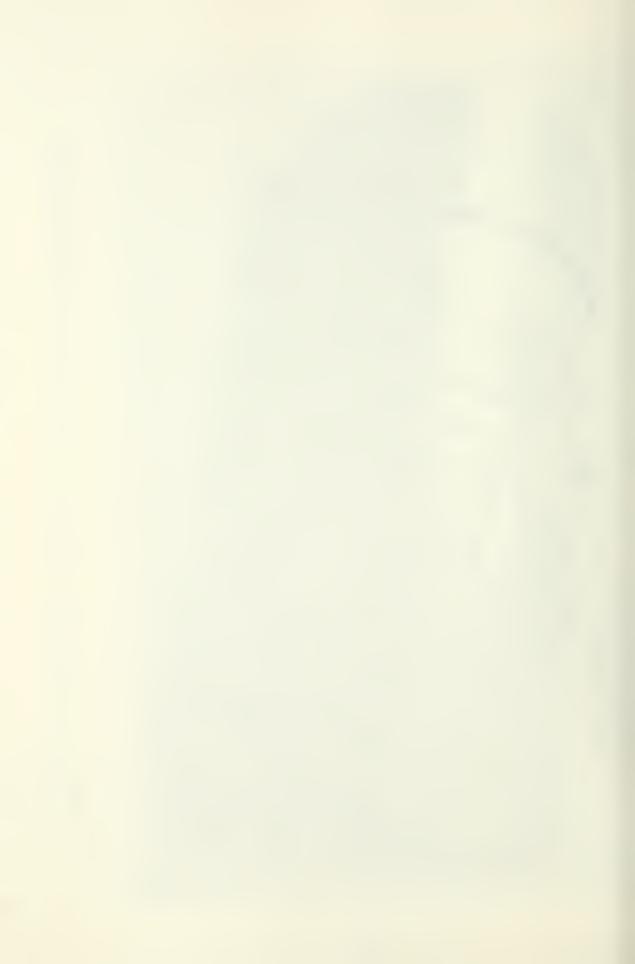




(CONTINUED) DETAILED PHOTO OF SHROUD TERMINATION AND DIFFUSOR RING INSTALLATION FIGURE 21.



PORTED MIXING STACK WITH DIFFUSOR RING AND FLOW-THROUGH SHROUD FIGURE 22.



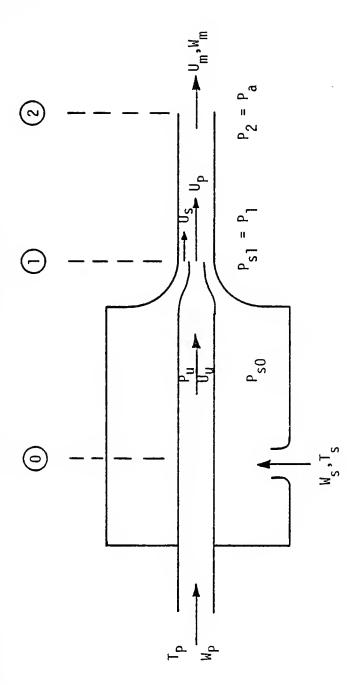


FIGURE 23. SIMPLE SINGLE NOZZLE EDUCTOR SYSTEM

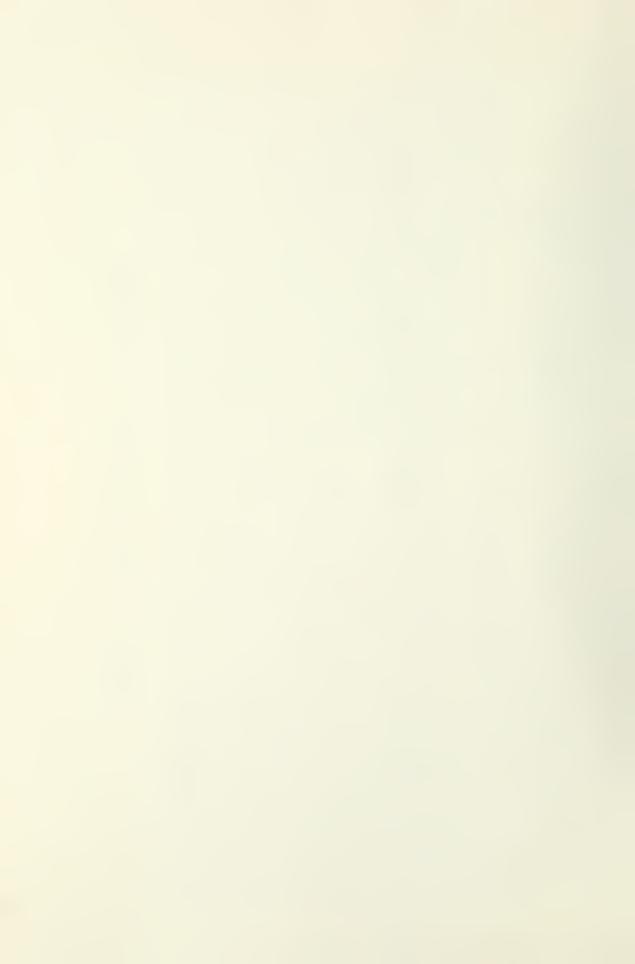




FIGURE 24. SECONDARY AND TERTIARY AIR PLENUMS



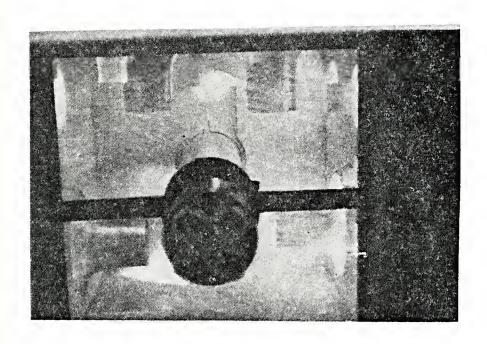
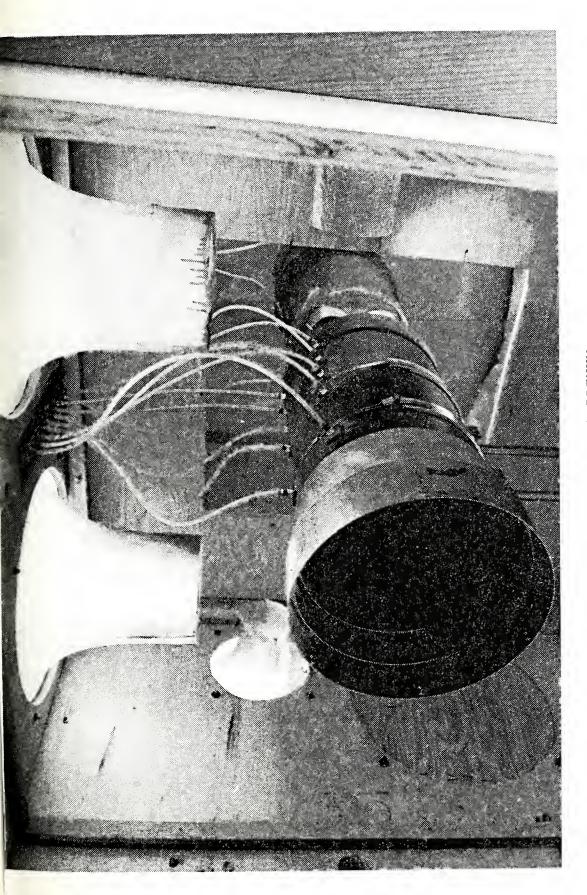


FIGURE 25. INTERIOR OF SECONDARY AIR PLENUM SHOWING FLOW STRAIGHTENER AND ASME LONG RADIUS FLOW NOZZLES







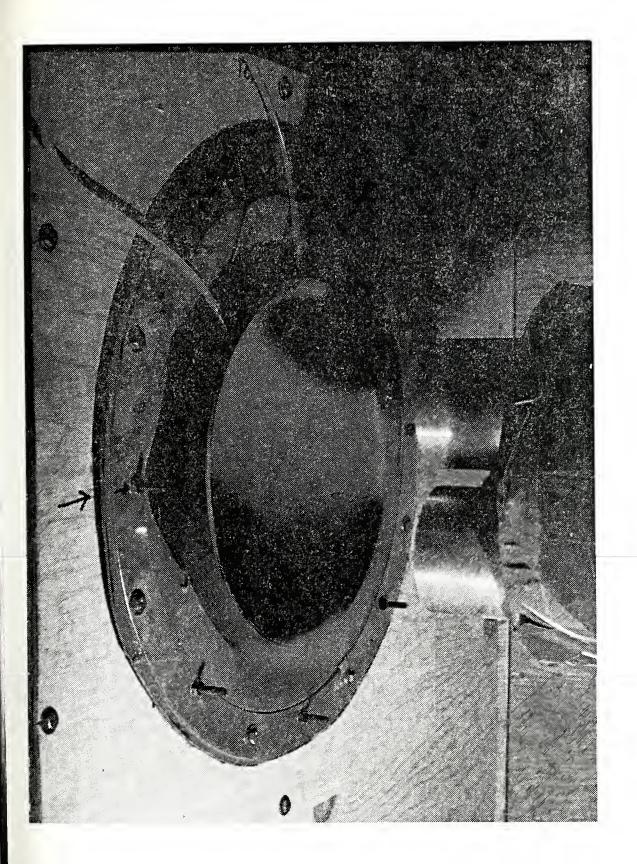


FIGURE 27. MIXING STACK ENTRANCE WITH AIR SEAL IN PLACE



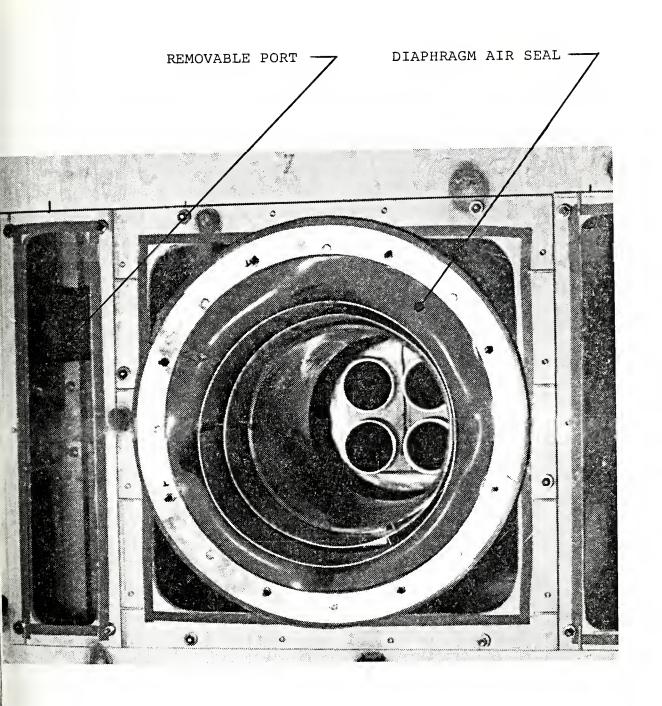


FIGURE 28. MIXING STACK EXIT WITH AIR SEAL IN PLACE



FIGURE 29. INTERIOR OF TERTIARY PLENUM



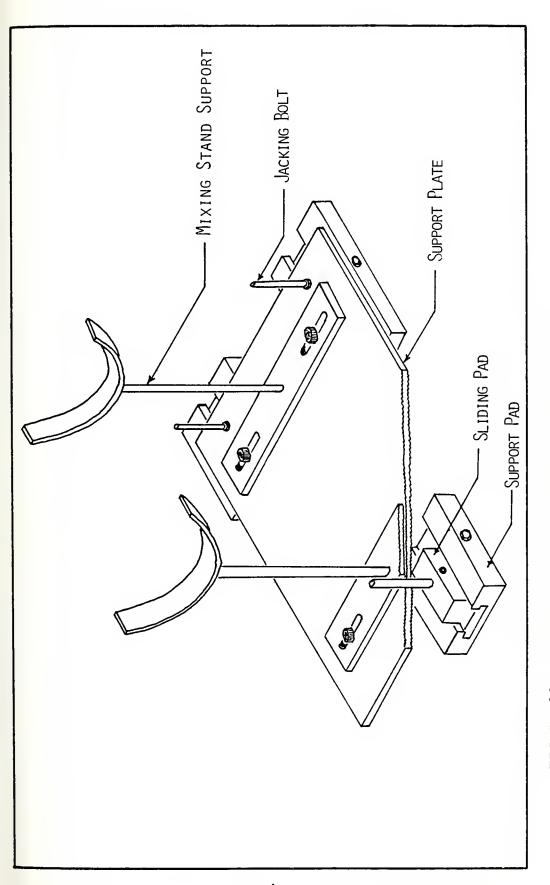


FIGURE 30. SKETCH OF MIXING STACK SUPPORT STAND



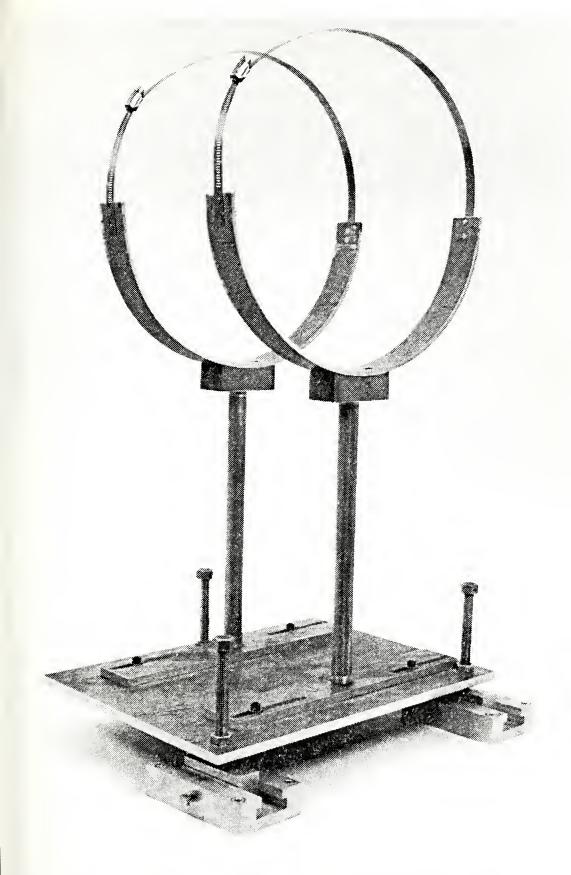
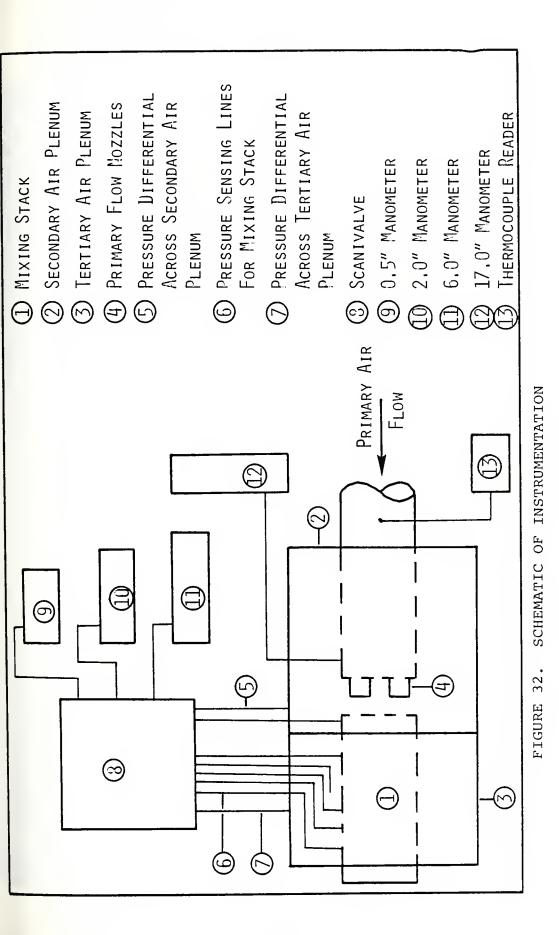
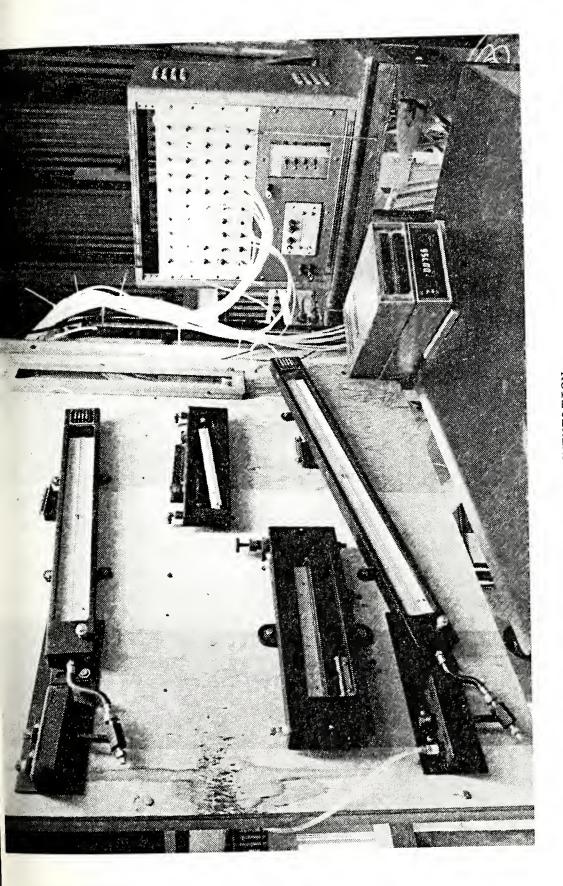


FIGURE 31. PHOTOGRAPH OF MIXING STACK SUPPORT STAND

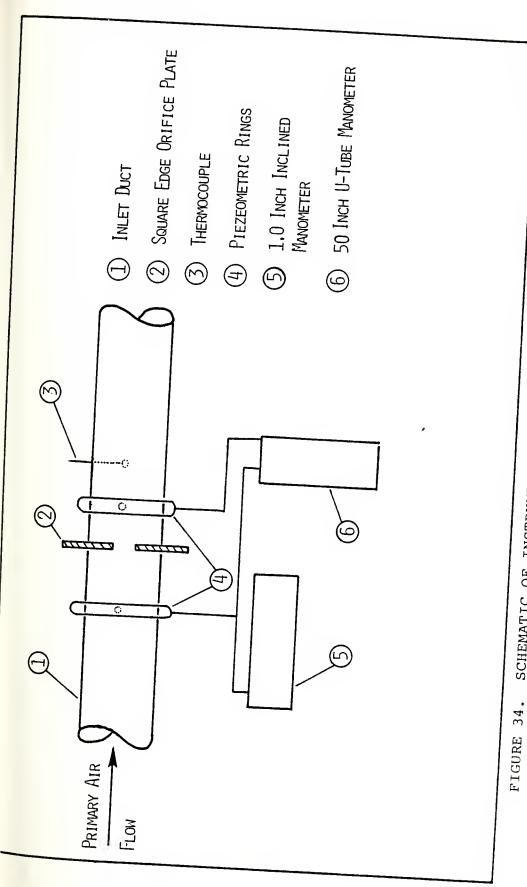






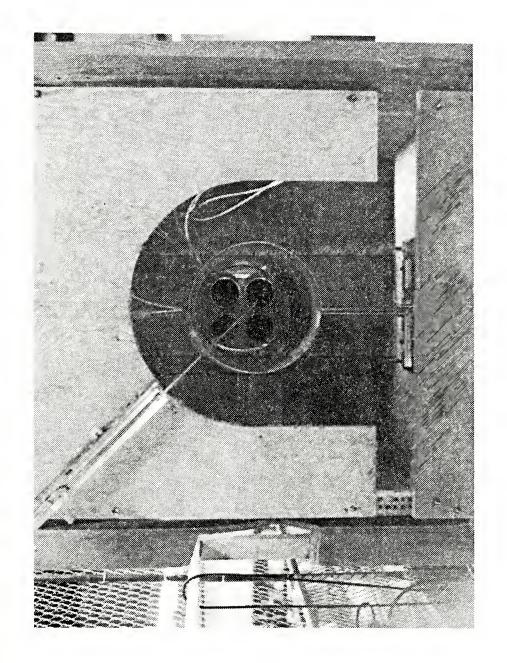






SCHEMATIC OF INSTRUMENTATION FOR PRIMARY AIR FLOW MEASUREMENT







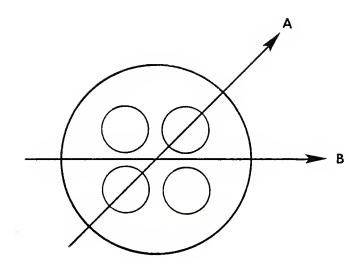


FIGURE 36. ORIENTATION OF MIXING STACK EXIT VELOCITY TRAVERSES



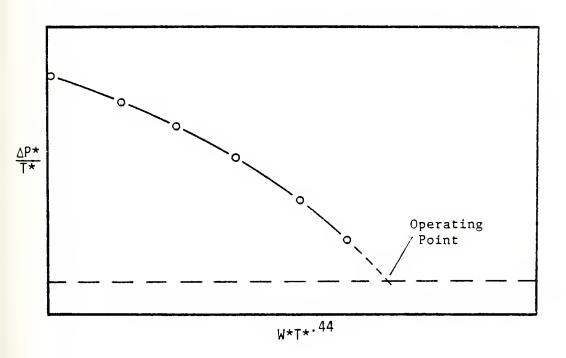


FIGURE 37. ILLUSTRATIVE PLOT OF THE EXPERIMENTAL DATA CORRELATION IN EQUATION (14)



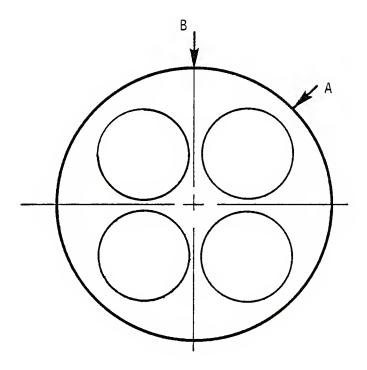
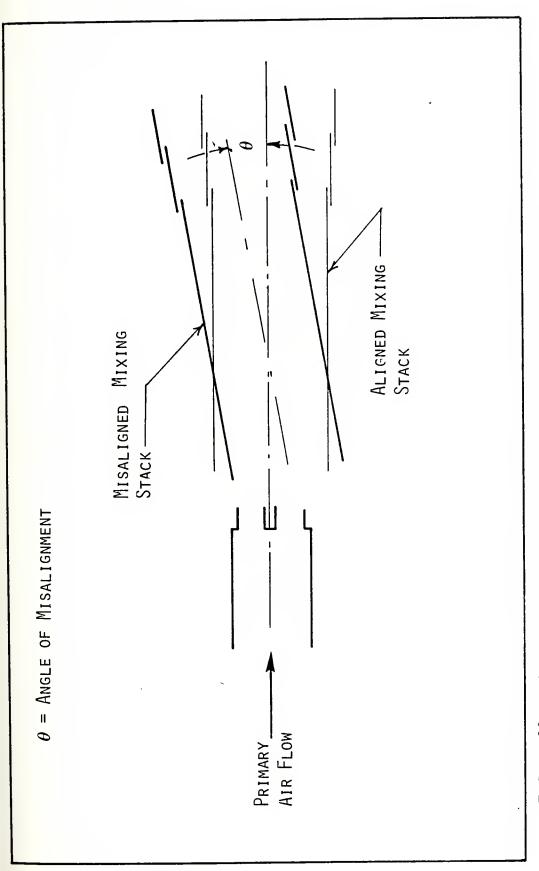


FIGURE 38. ORIENTATION OF STATIC PRESSURE TAPS RELATIVE TO PRIMARY FLOW NOZZLES





SCHEMATIC ILLUSTRATION OF MIXING STACK MISALIGNMENT FIGURE 39.



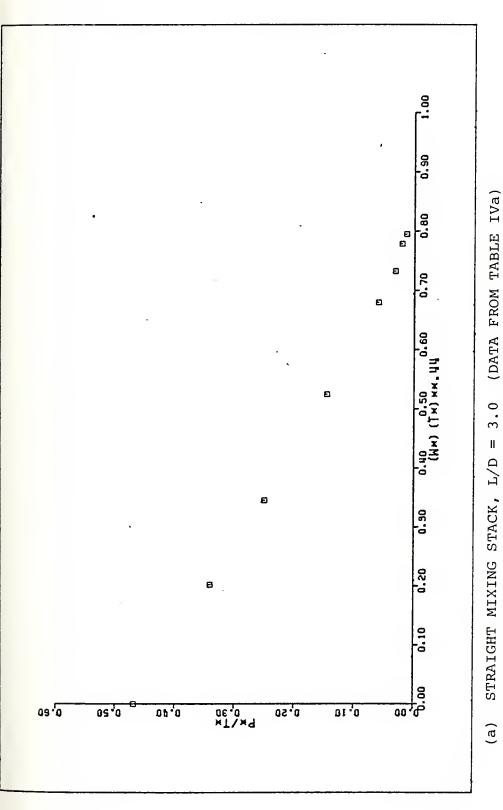


FIGURE 40. PERFORMANCE PLOTS



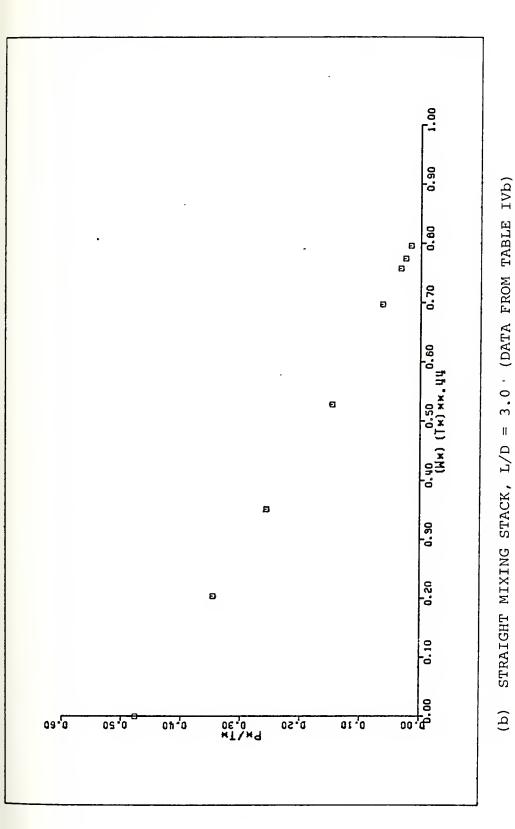
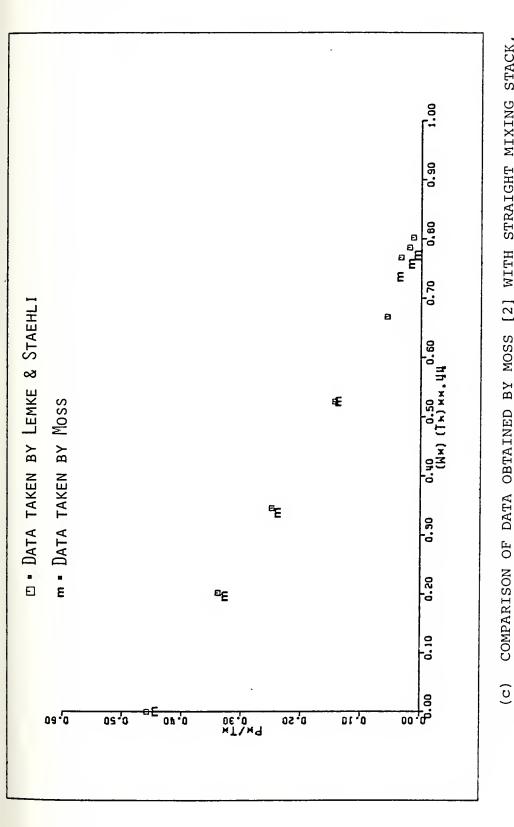


FIGURE 40 (CONTINUED)

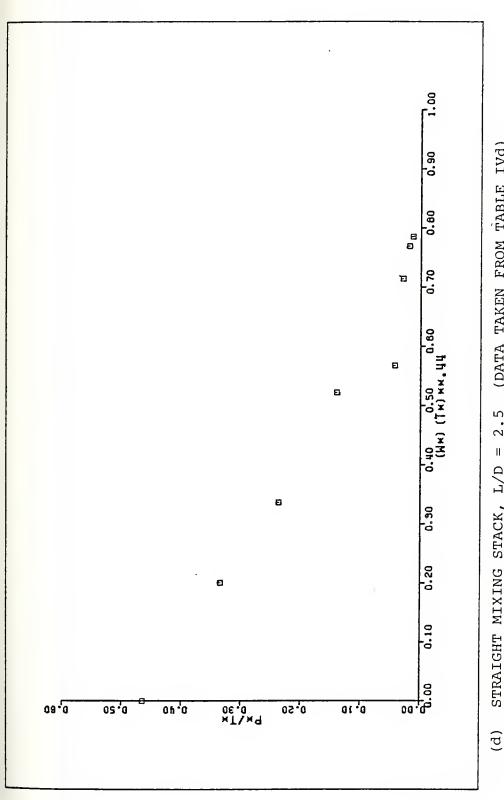




COMPARISON OF DATA OBTAINED BY MOSS [2] WITH STRAIGHT MIXING STACK, L/D = 3.0 (DATA TAKEN FROM TABLE IVC)

FIGURE 40 (CONTINUED)





(DATA TAKEN FROM TABLE IVG) 2.5 STRAIGHT MIXING STACK, L/D =

FIGURE 40 (CONTINUED)



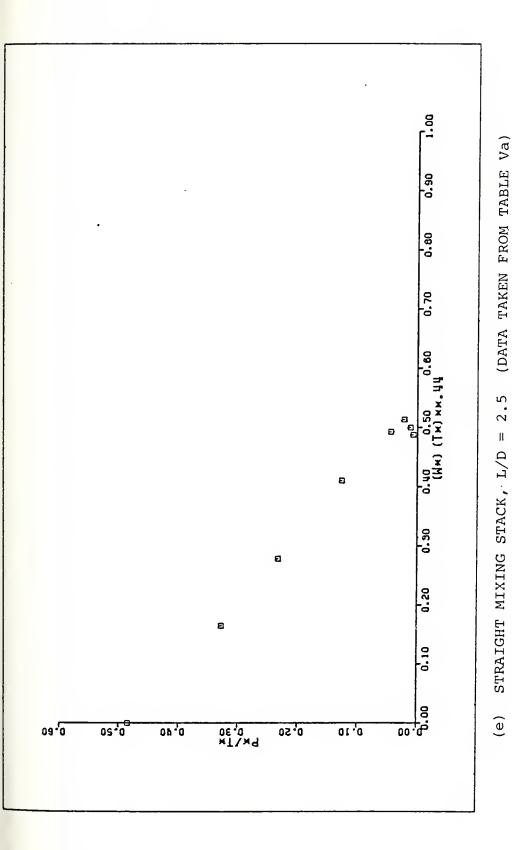
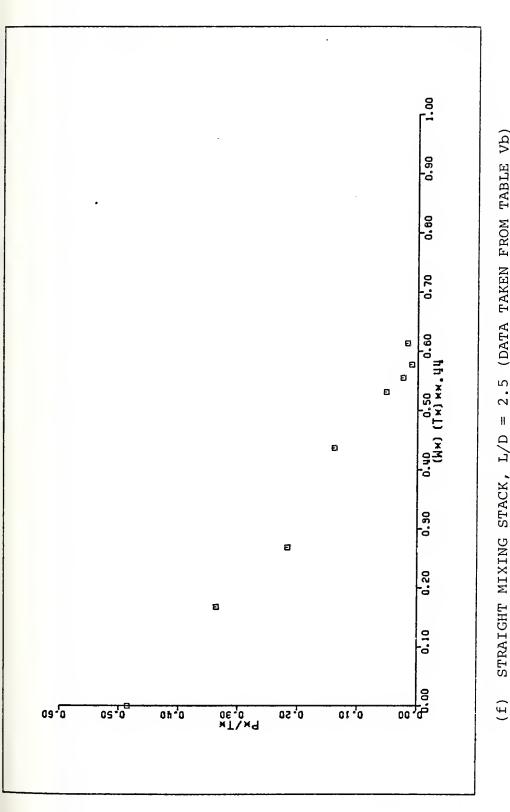


FIGURE 40 (CONTINUED)

114

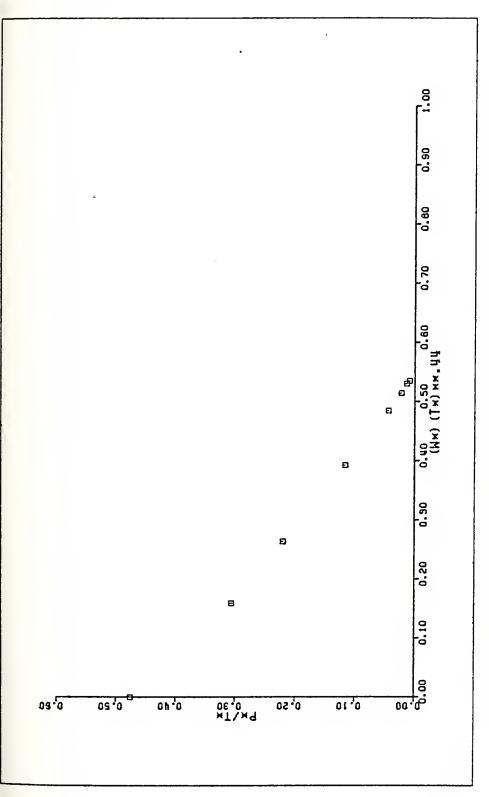




STRAIGHT MIXING STACK, L/D = 2.5 (DATA TAKEN FROM TABLE Vb)

FIGURE 40 (CONTINUED)





(DATA TAKEN FROM TABLE VC) STRAIGHT MIXING STACK, L/D = 1.75(g)

FIGURE 40 (CONTINUED)



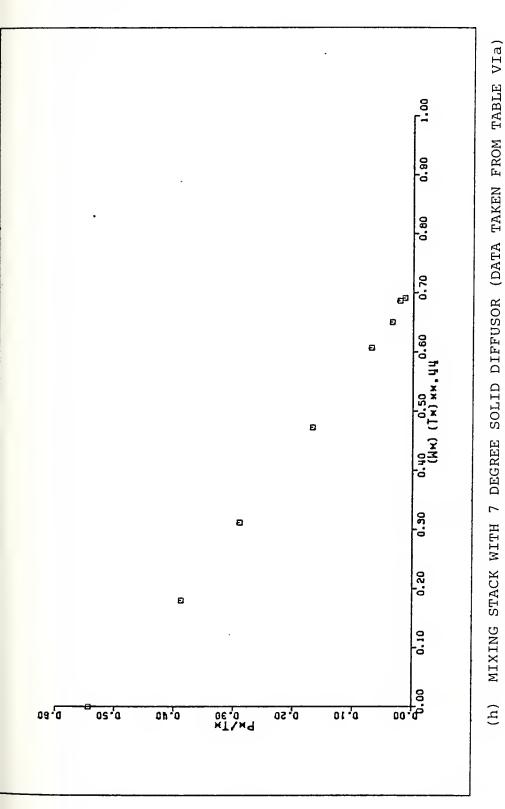


FIGURE 40 (CONTINUED)



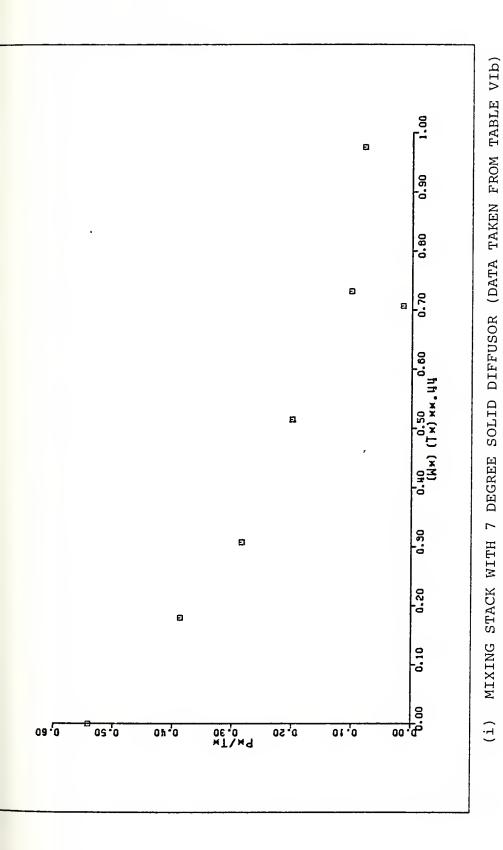


FIGURE 40 (CONTINUED)



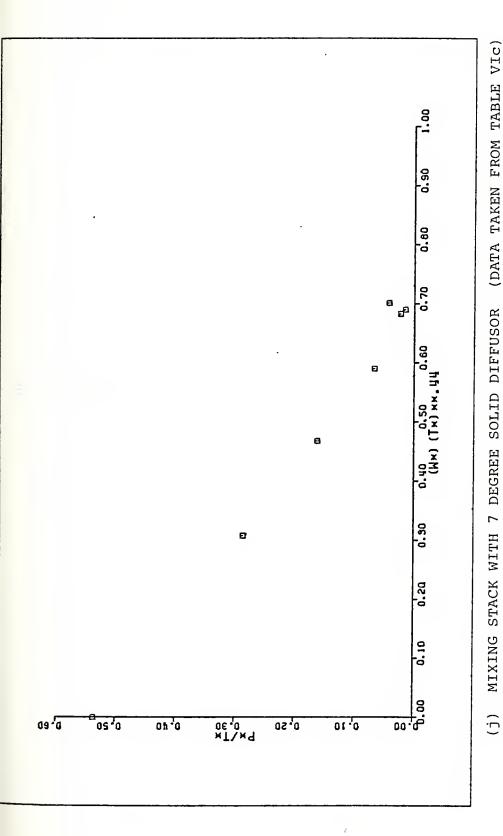
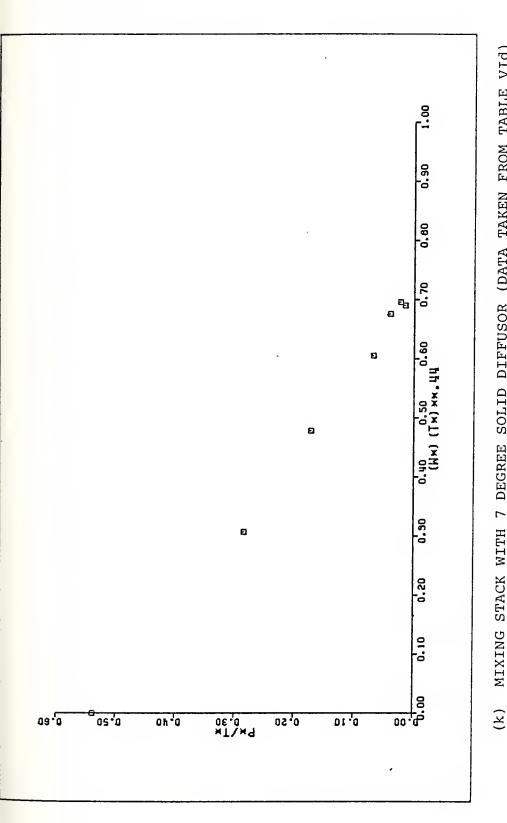


FIGURE 40 (CONTINUED)





MIXING STACK WITH 7 DEGREE SOLID DIFFUSOR (DATA TAKEN FROM TABLE VId)

FIGURE 40 (CONTINUED)



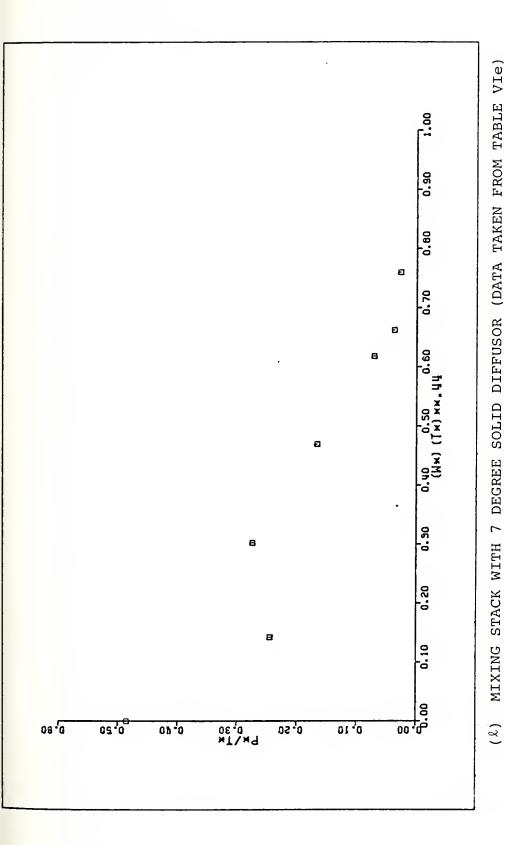


FIGURE 40 (CONTINUED)



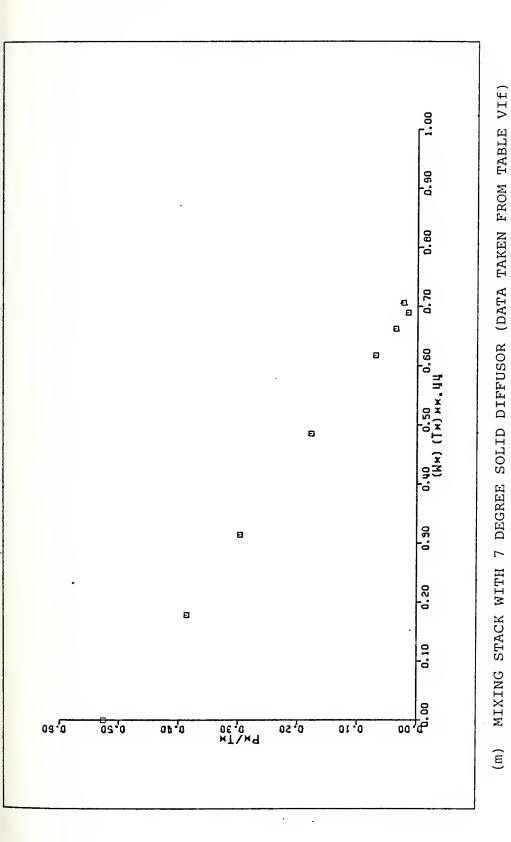


FIGURE 40 (CONTINUED)



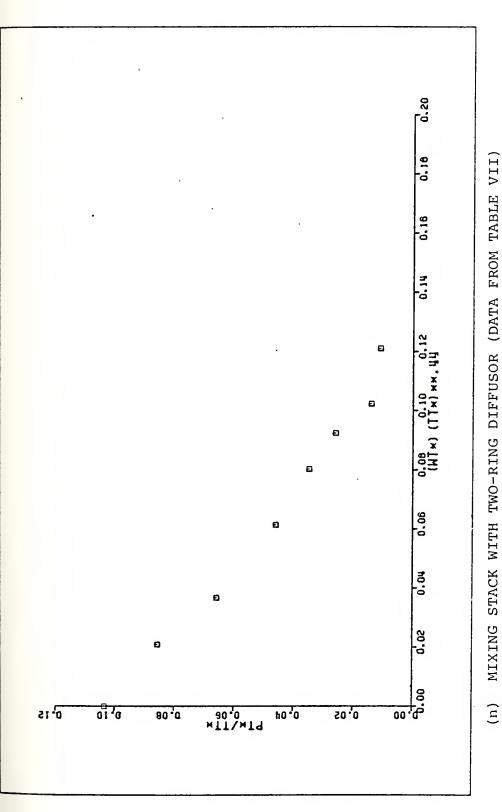


FIGURE 40 (CONTINUED)



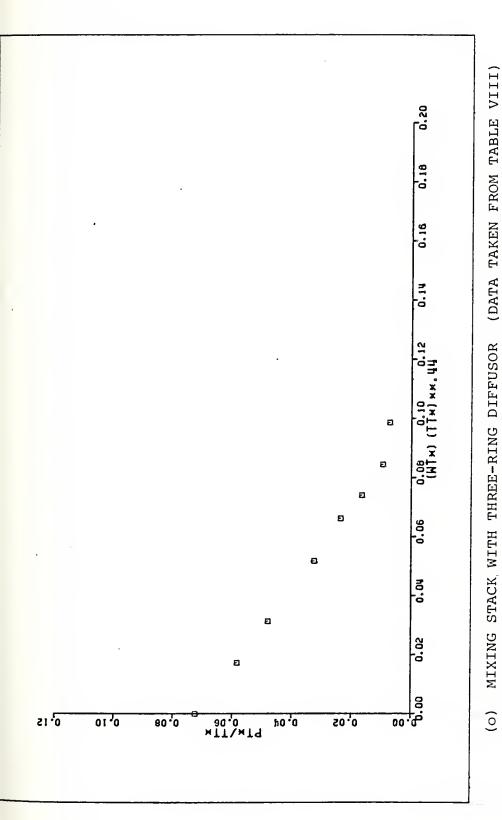


FIGURE 40 (CONTINUED)



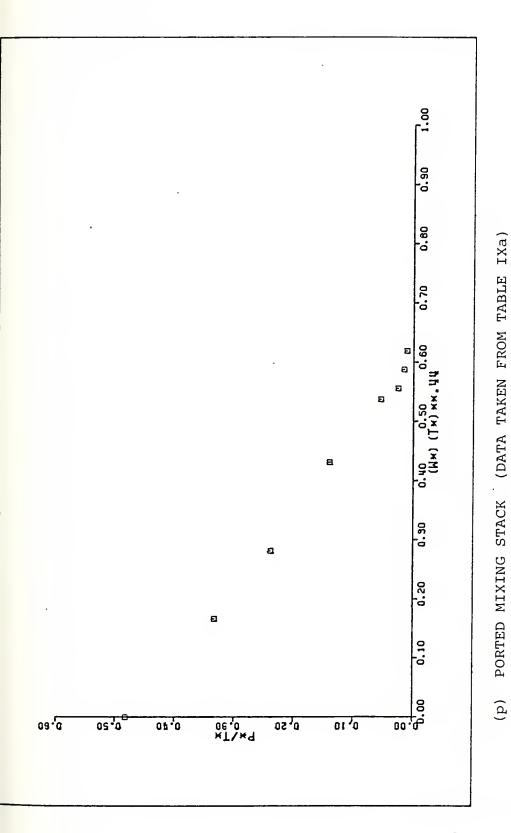


FIGURE 40 (CONTINUED)



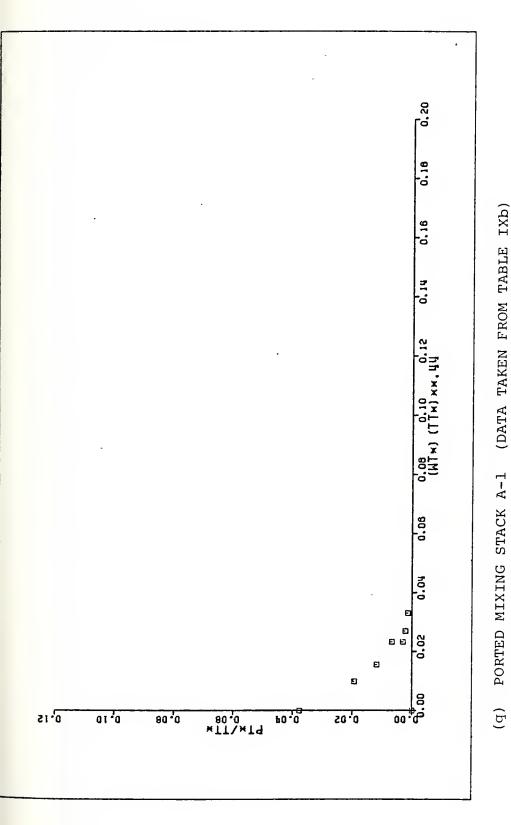


FIGURE 40 (CONTINUED)



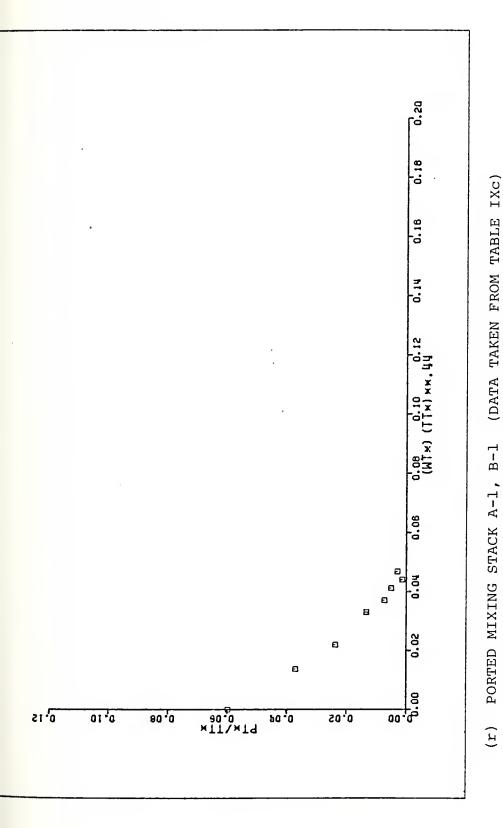
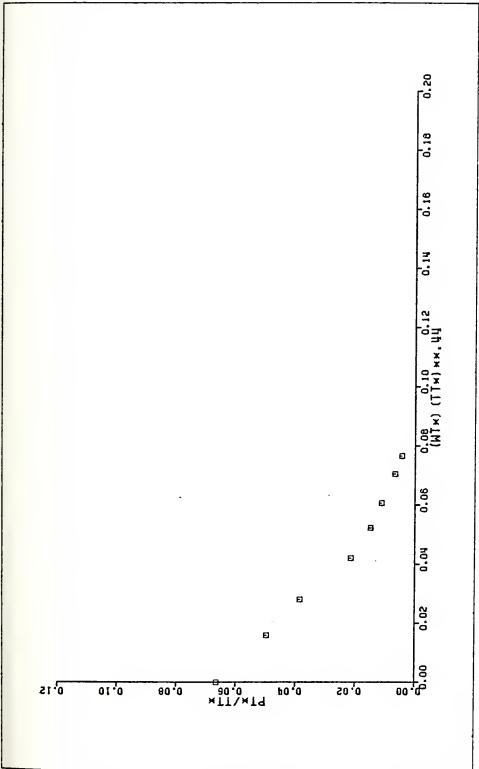


FIGURE 40 (CONTINUED)





(DATA TAKEN FROM TABLE IXd) PORTED MIXING STACK A-1, B-1, C-2

FIGURE 40 (CONTINUED)

(s)



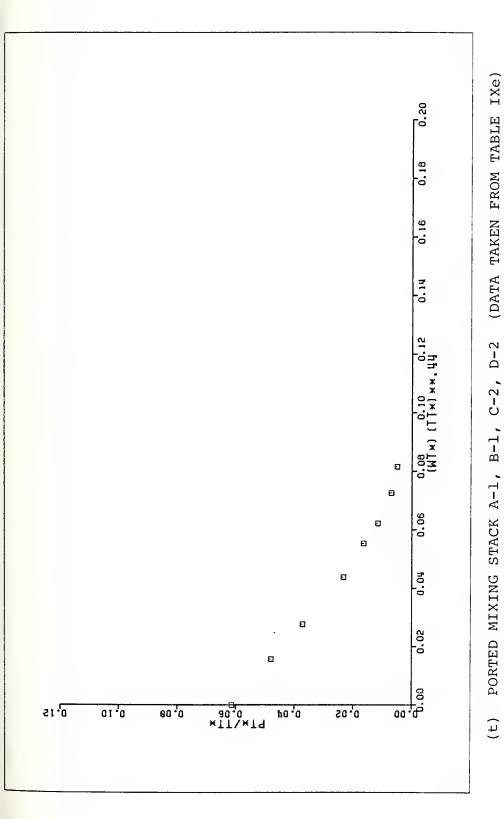


FIGURE 40 (CONTINUED)



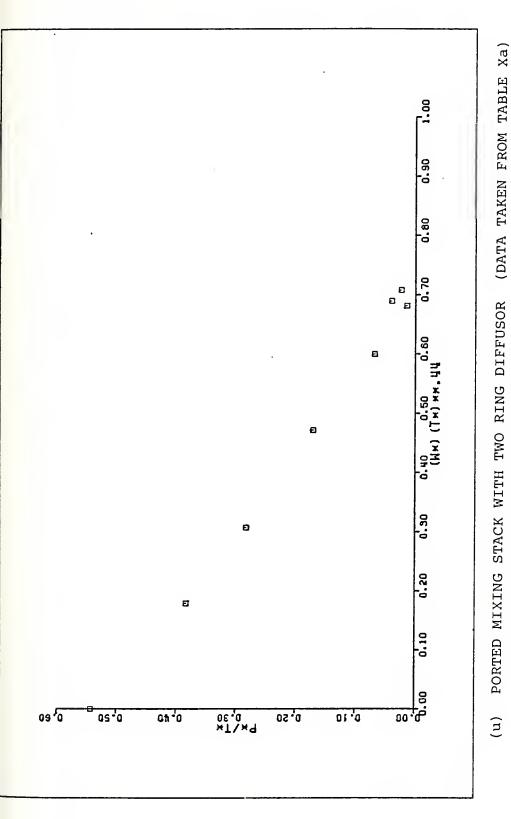


FIGURE 40 (CONTINUED)



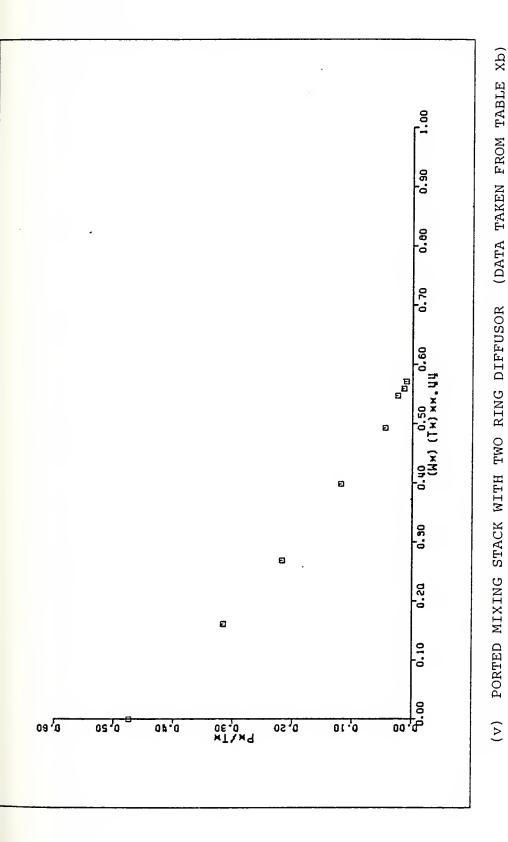


FIGURE 40 (CONTINUED)



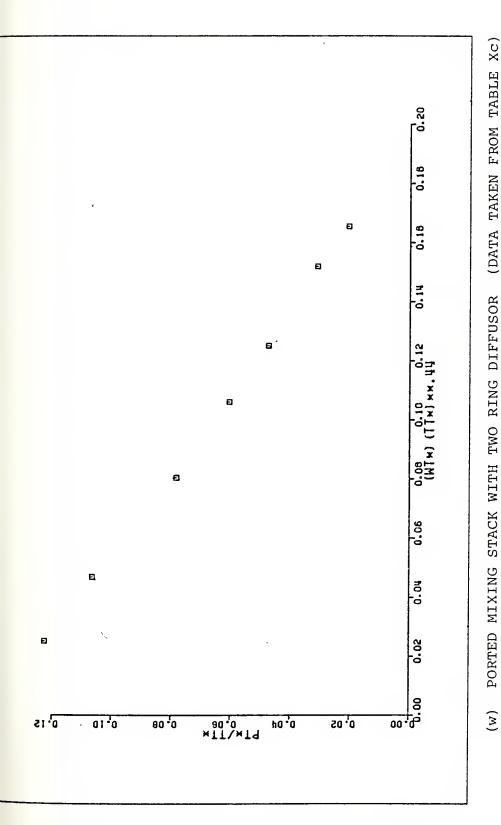


FIGURE 40 (CONTINUED)



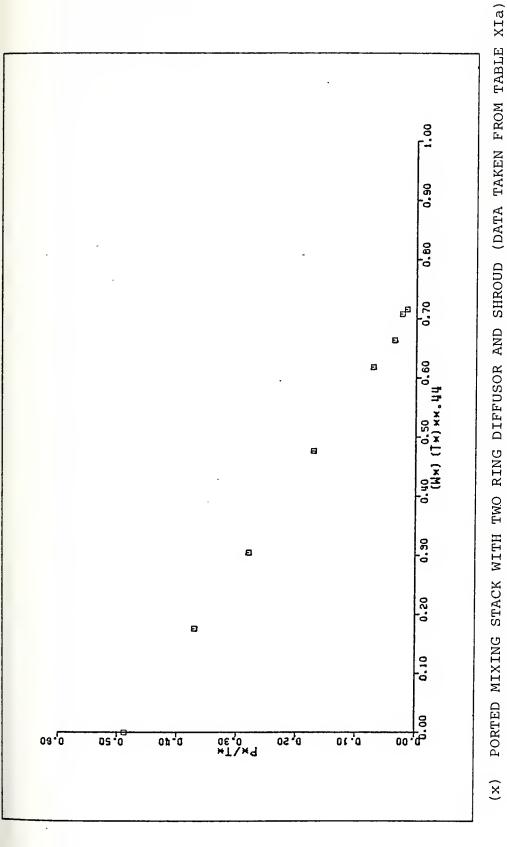
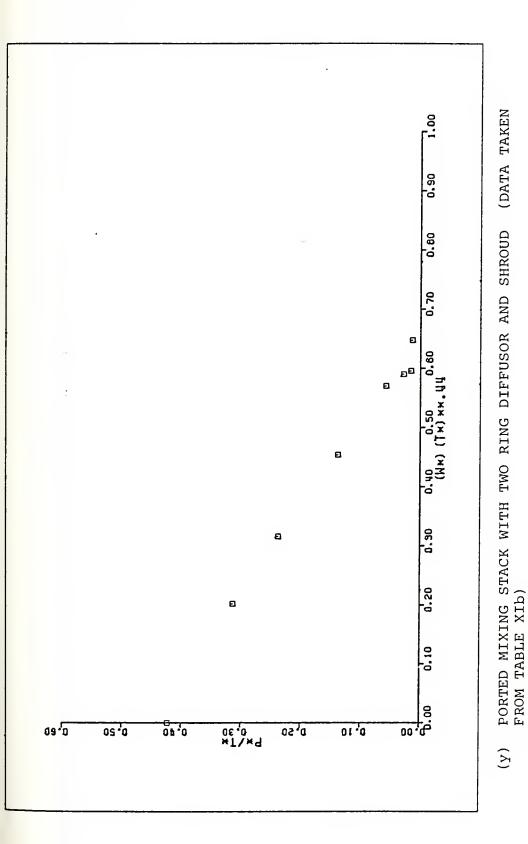


FIGURE 40 (CONTINUED)

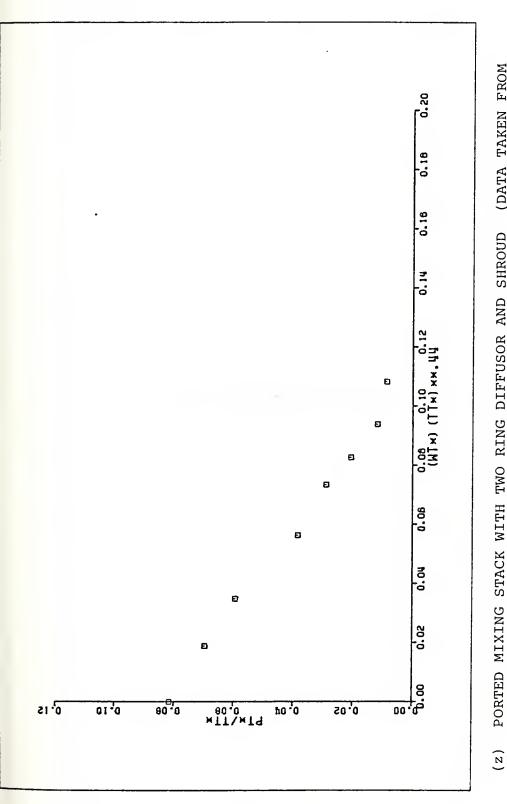




(CONTINUED)

FIGURE 40

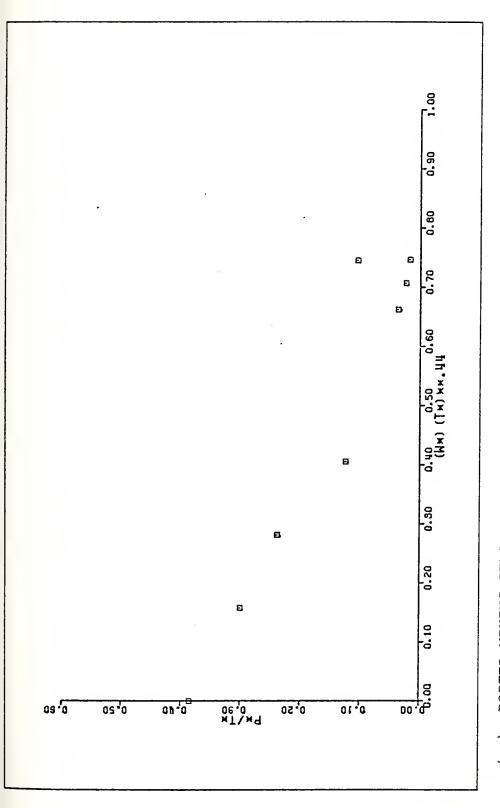




(DATA TAKEN FROM PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD TABLE XIC)

FIGURE 40 (CONTINUED)

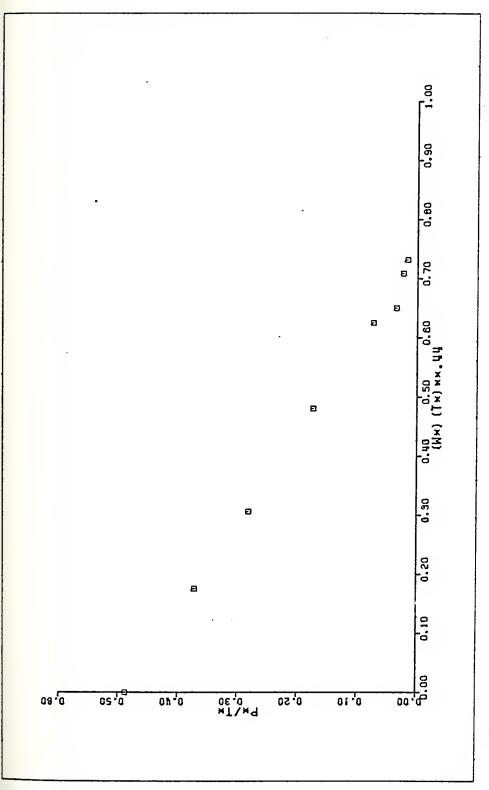




PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD (DATA TAKEN FROM TABLE XIA) (aa)

FIGURE 40 (CONTINUED)

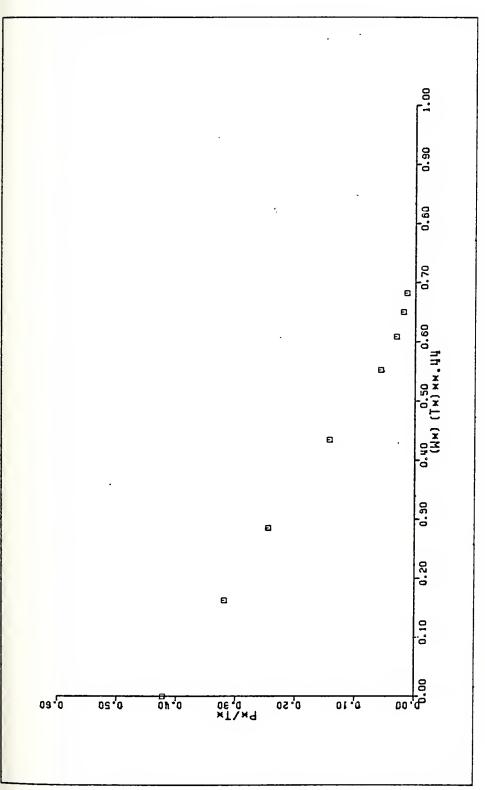




(DATA TAKEN FROM PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD TABLE XIIa) (pp)

FIGURE 40 (CONTINUED)

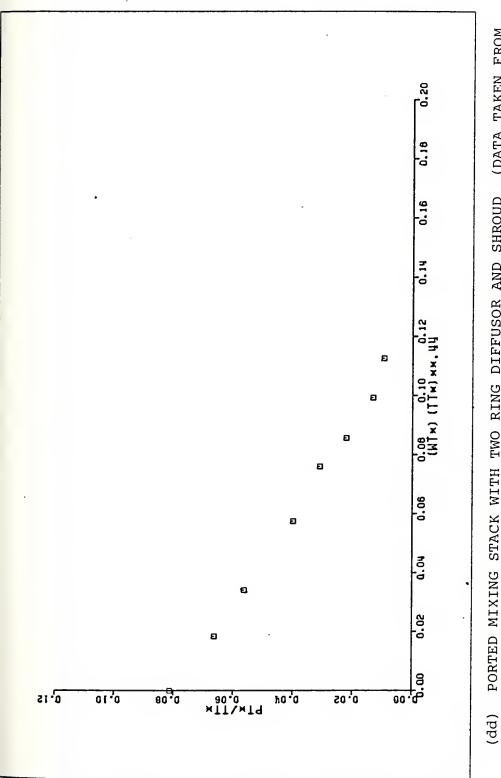




PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD (DATA TAKEN FROM TABLE XIIb) (cc)

FIGURE 40 (CONTINUED)

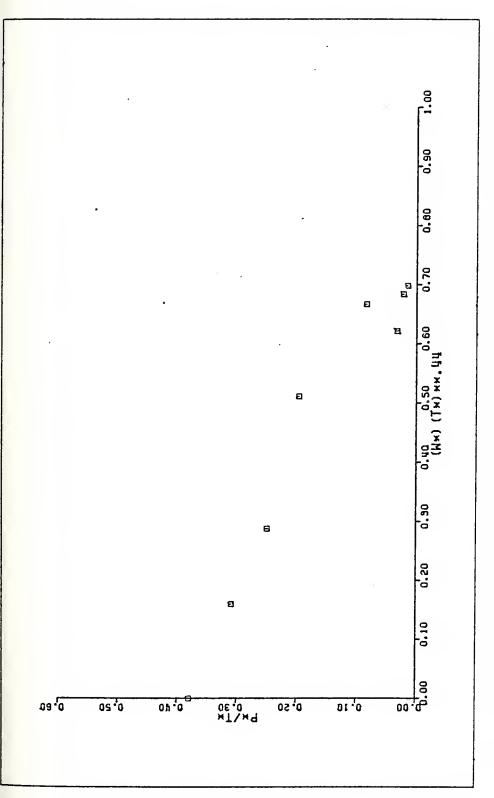




(DATA TAKEN FROM PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD TABLE XIIC)

FIGURE 40 (CONTINUED)

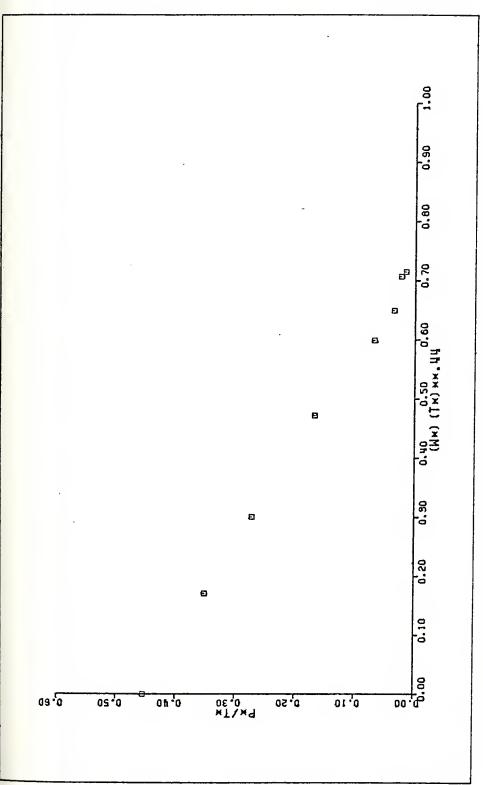




(DATA TAKEN FROM PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD TABLE XIId) (ee)

FIGURE 40 (CONTINUED)

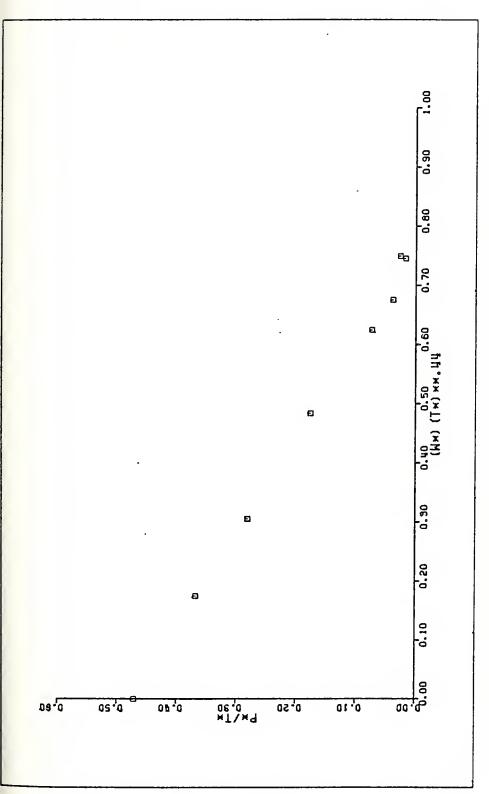




PORTED MIXING STACK WITH RING DIFFUSOR AND FLOW-THROUGH SHROUD (DATA TAKEN FROM TABLE XIIIA) (ff)

FIGURE 40 (CONTINUED)

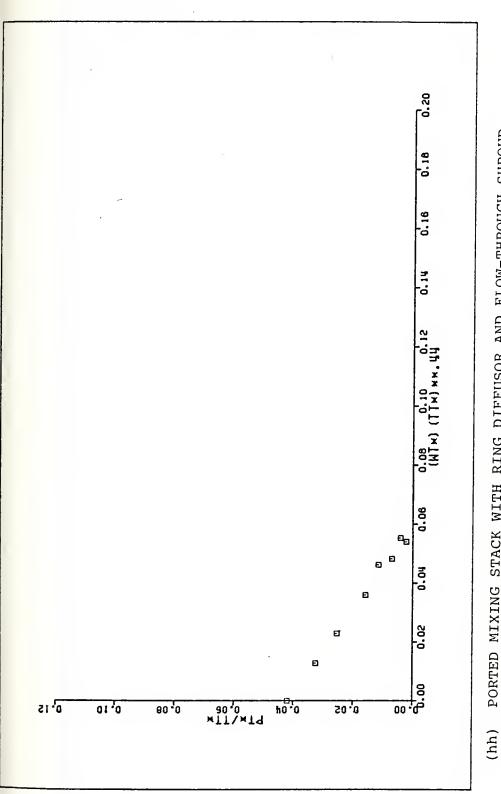




PORTED MIXING STACK WITH RING DIFFUSOR AND FLOW-THROUGH SHROUD (DATA TAKEN FROM TABLE XIIIb) (gg)

FIGURE 40 (CONTINUED)

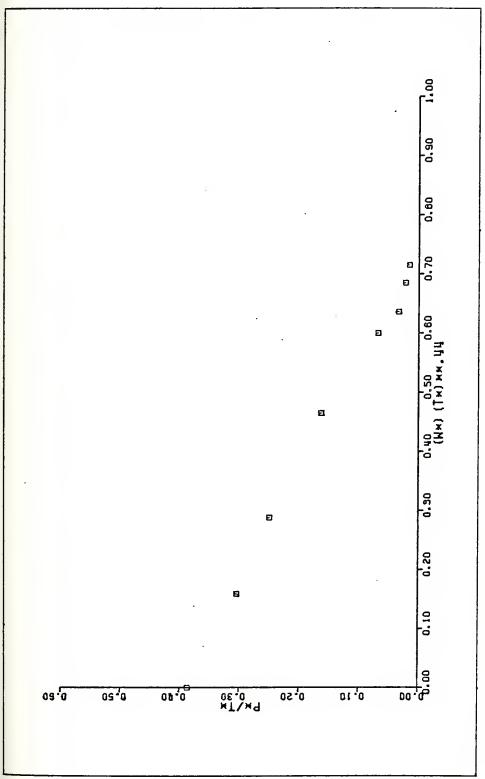




PORTED MIXING STACK WITH RING DIFFUSOR AND FLOW-THROUGH SHROUD (DATA TAKEN FROM TABLE XIIIC)

FIGURE 40 (CONTINUED)





PORTED MIXING STACK WITH RING DIFFUSOR AND FLOW-THROUGH SHROUD (DATA TAKEN FROM TABLE XIIId) (ii)

FIGURE 40 (CONTINUED)



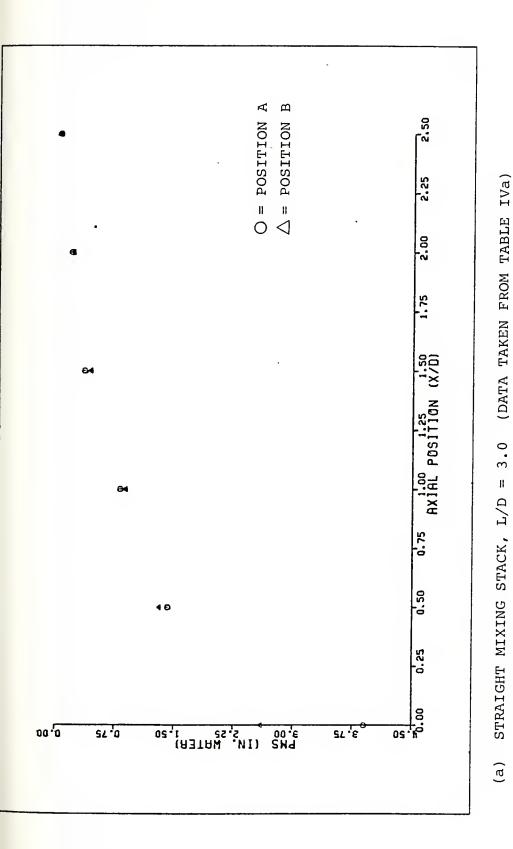


FIGURE 41. MIXING STACK PRESSURE DISTRIBUTION PLOTS



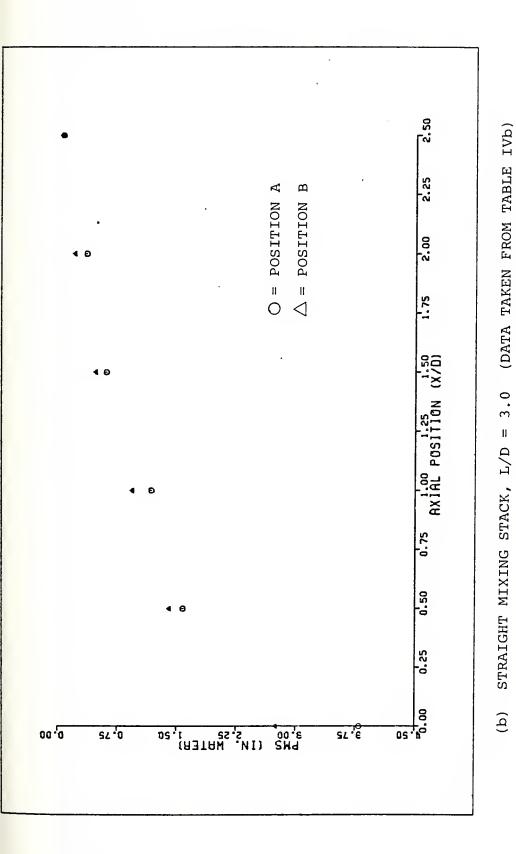
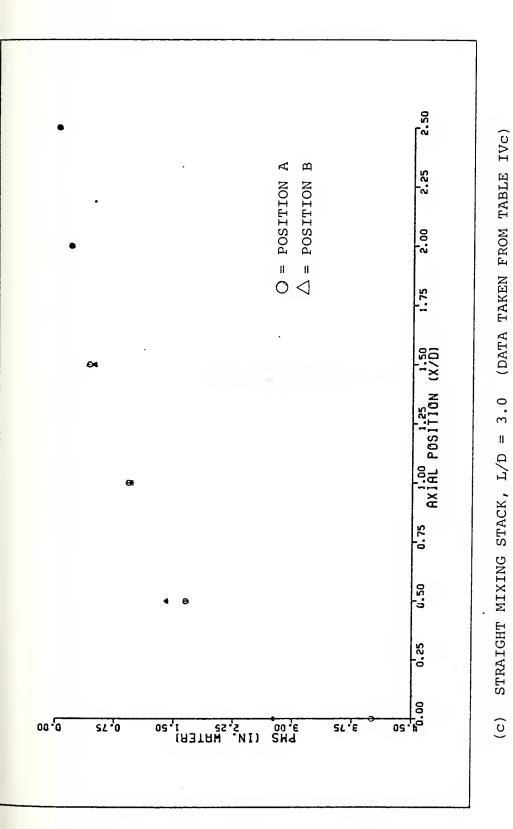


FIGURE 41 (CONTINUED)



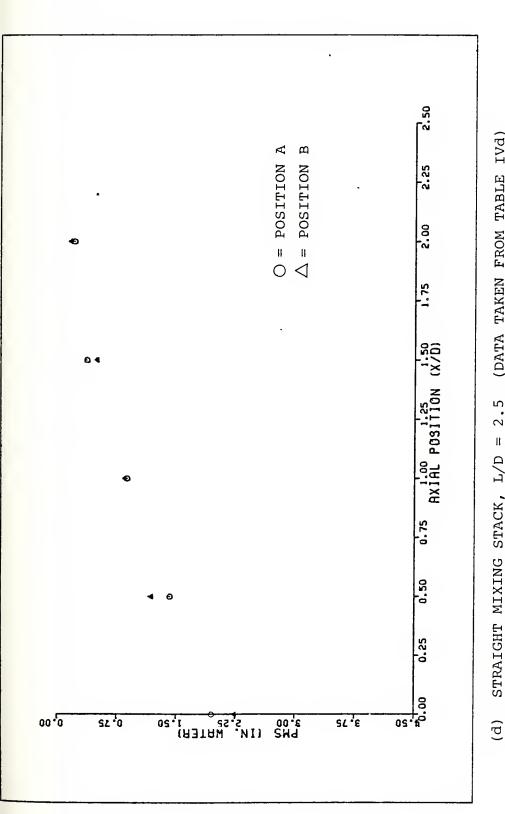


(CONTINUED)

FIGURE 41

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(DATA TAKEN FROM TABLE IVG) STRAIGHT MIXING STACK, L/D = 2.5

FIGURE 41 (CONTINUED)

148



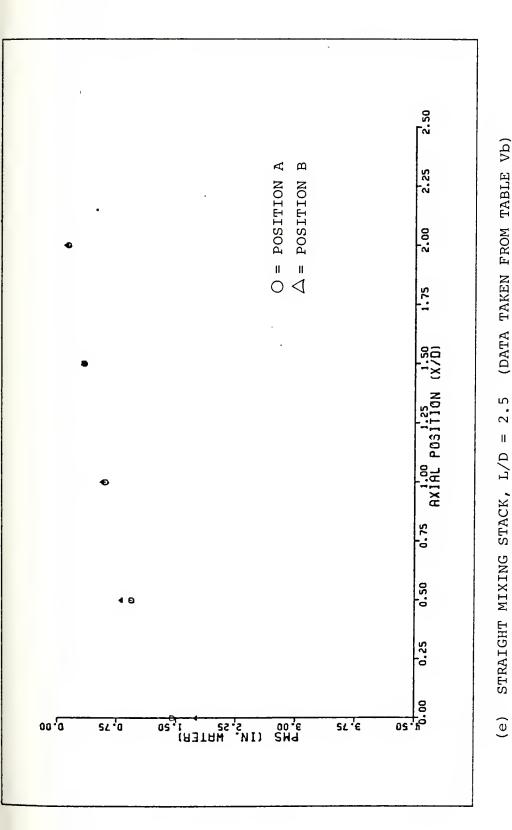
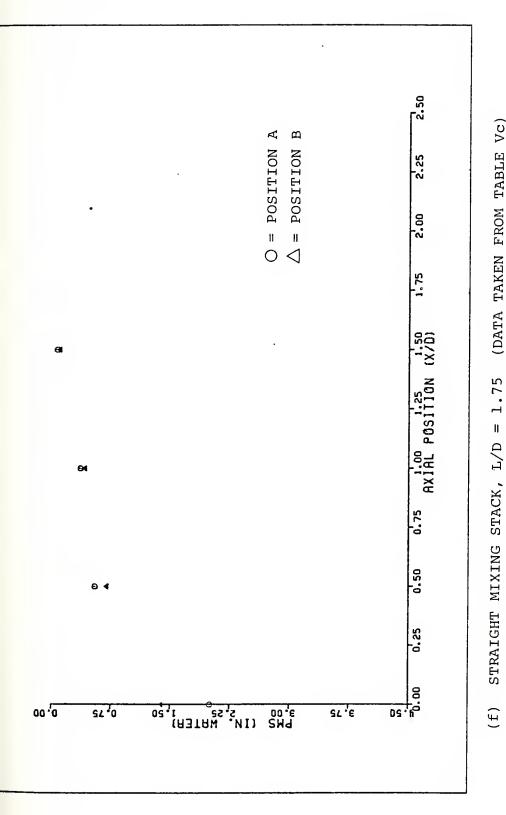


FIGURE 41 (CONTINUED)





(DATA TAKEN FROM TABLE VC)

FIGURE 41 (CONTINUED)



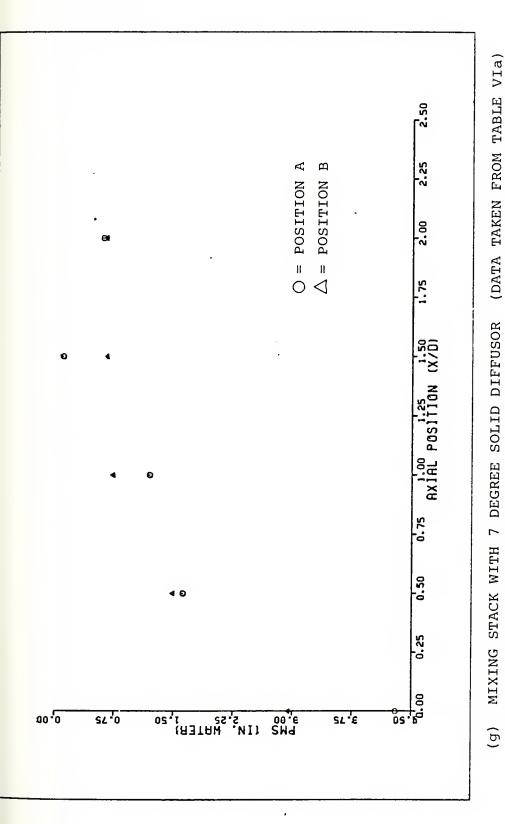


FIGURE 41 (CONTINUED)



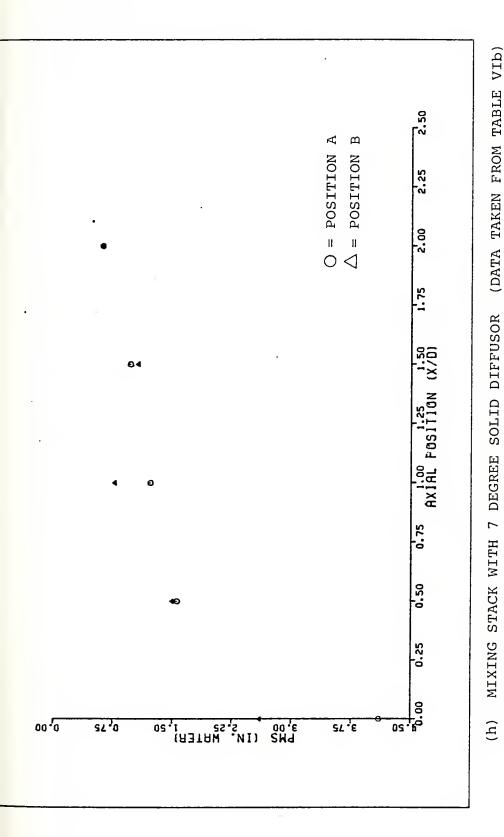
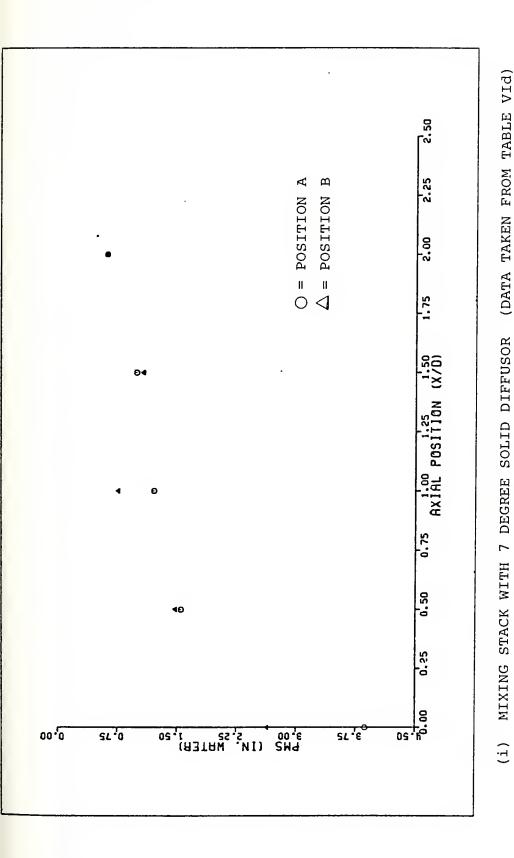


FIGURE 41 (CONTINUED)





(CONTINUED)

FIGURE 41



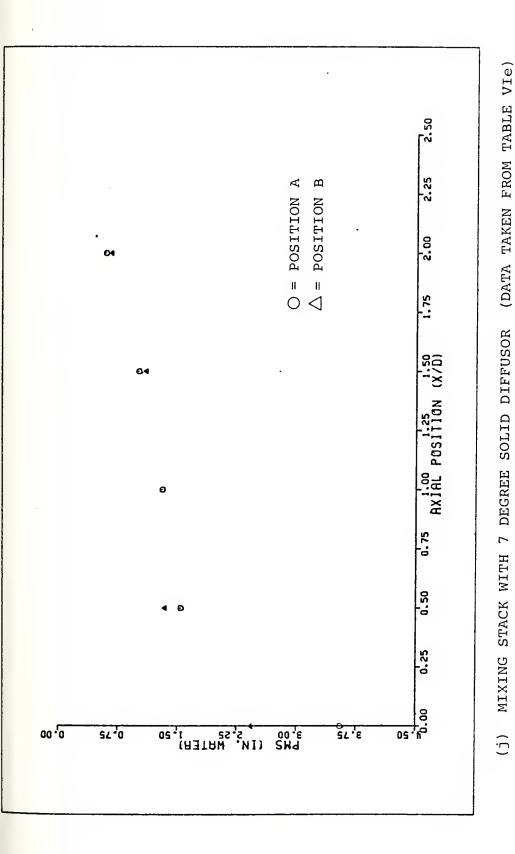
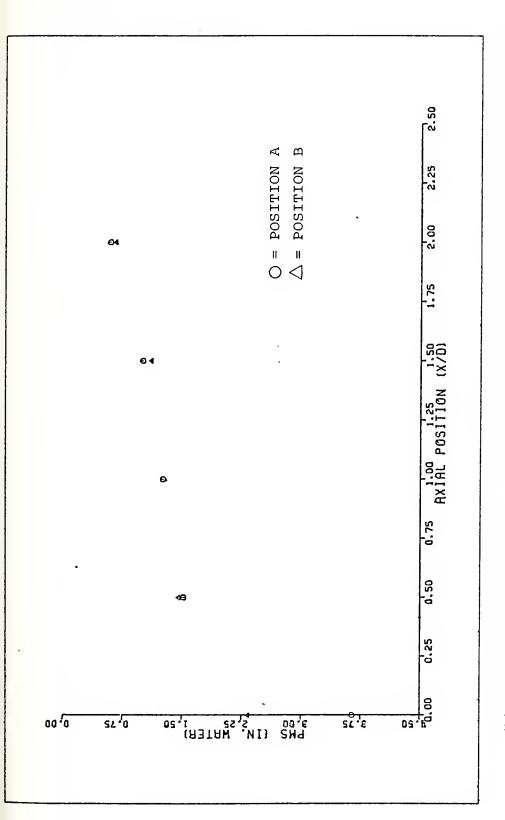


FIGURE 41 (CONTINUED)

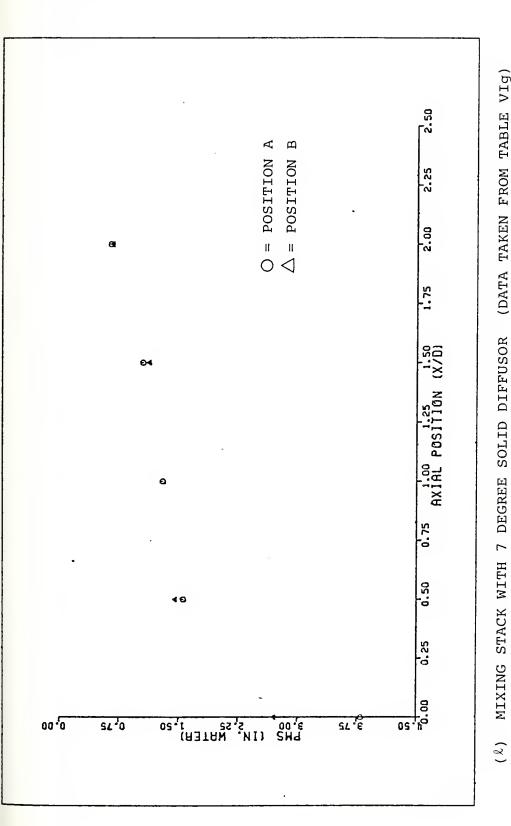




(DATA TAKEN FROM TABLE VIf) MIXING STACK WITH A 7 DEGREE SOLID DIFFUSOR (농

FIGURE 41 (CONTINUED)





(DATA TAKEN FROM TABLE VIG)

FIGURE 41 (CONTINUED)

156



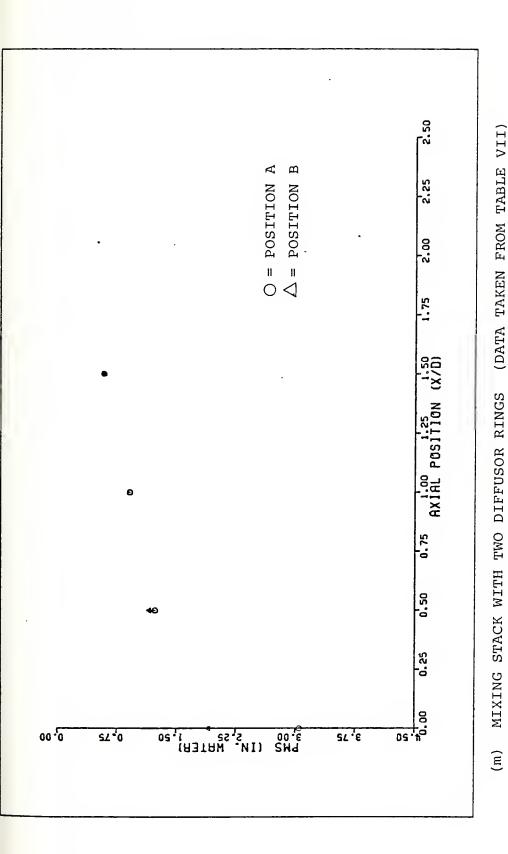
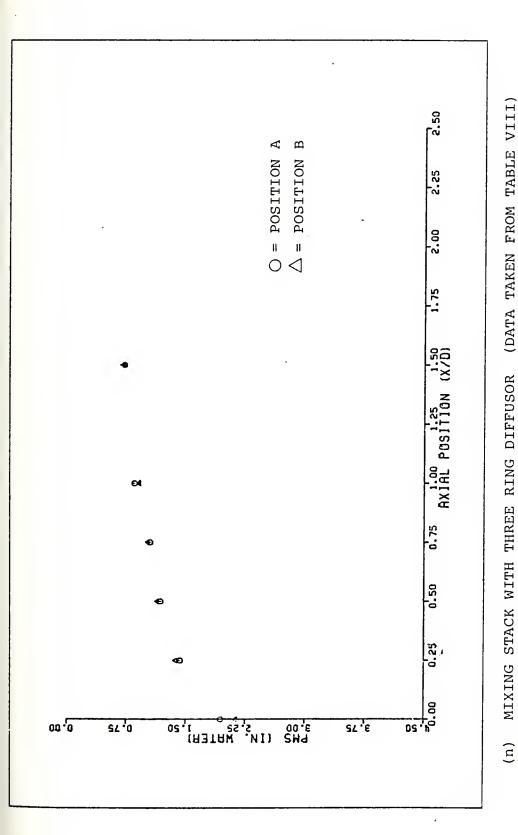


FIGURE 41 (CONTINUED)





(CONTINUED)

FIGURE 41



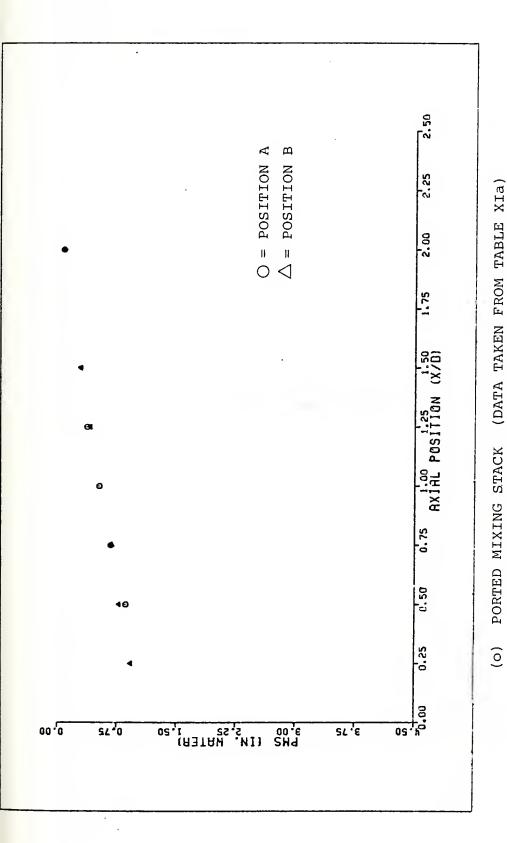


FIGURE 41 (CONTINUED)



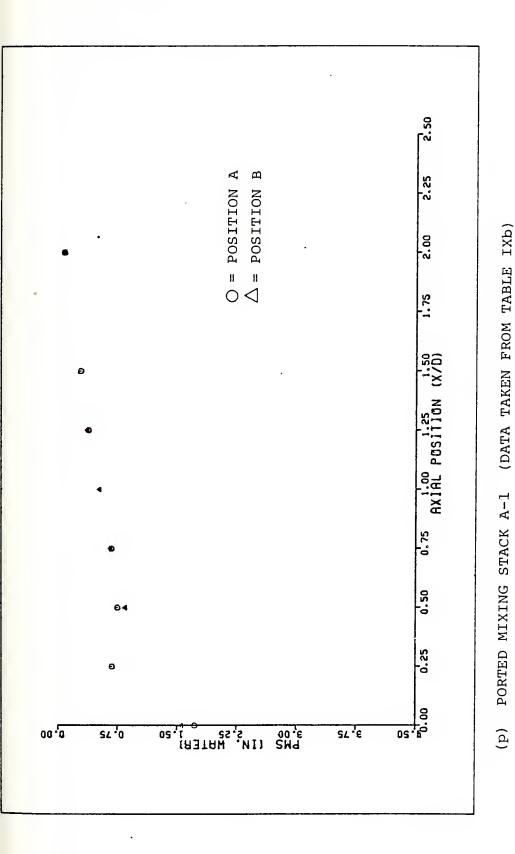


FIGURE 41 (CONTINUED)



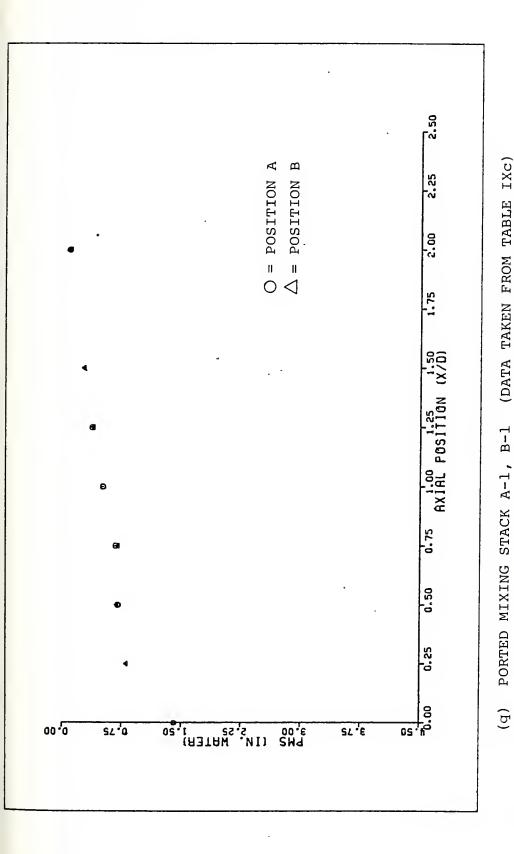


FIGURE 41 (CONTINUED)



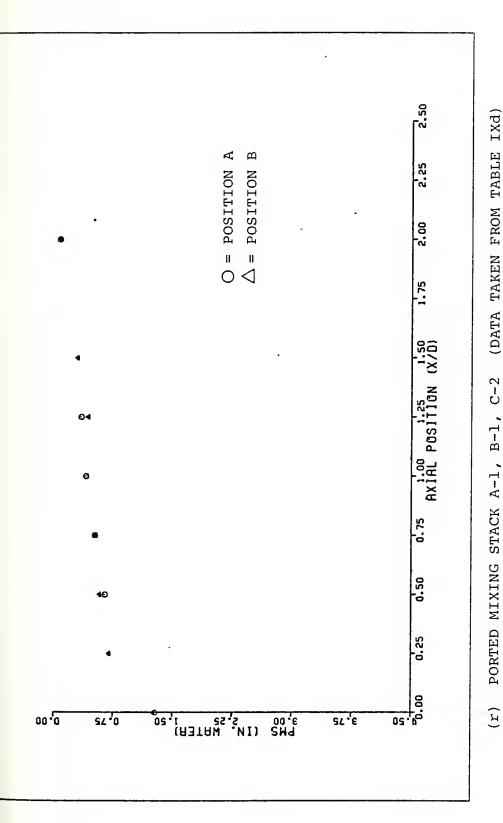


FIGURE 41 (CONTINUED)



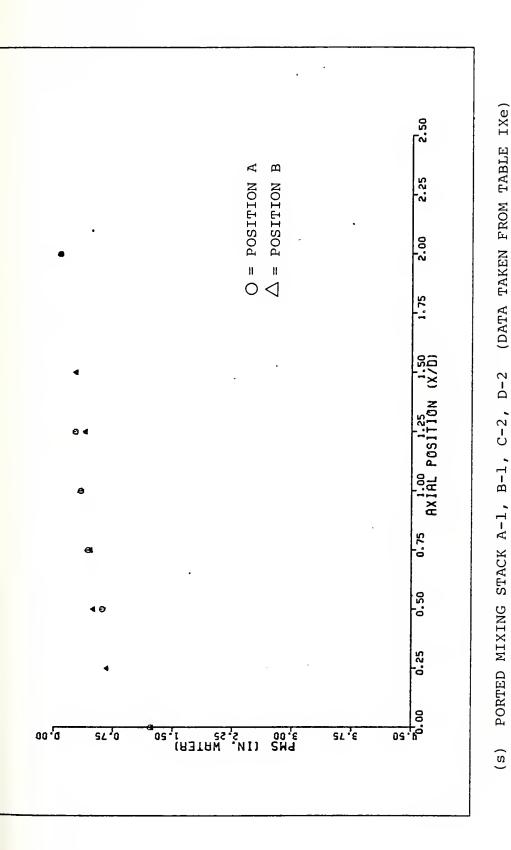


FIGURE 41 (CONTINUED)



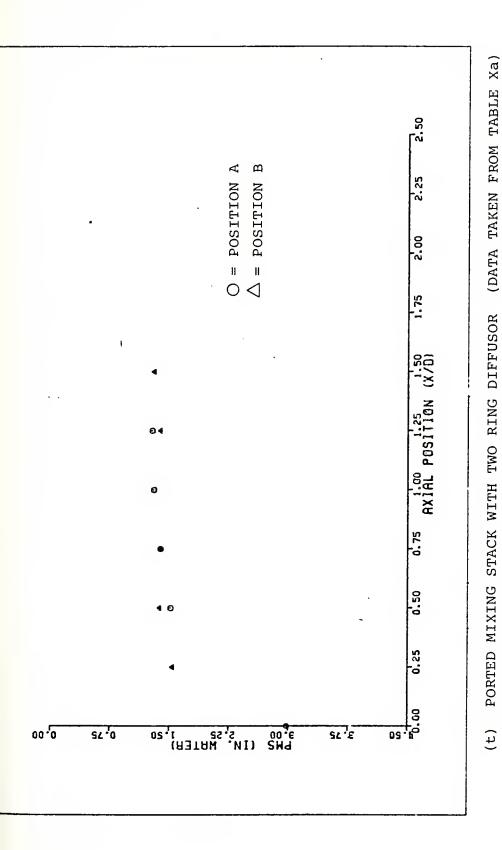


FIGURE 41 (CONTINUED)



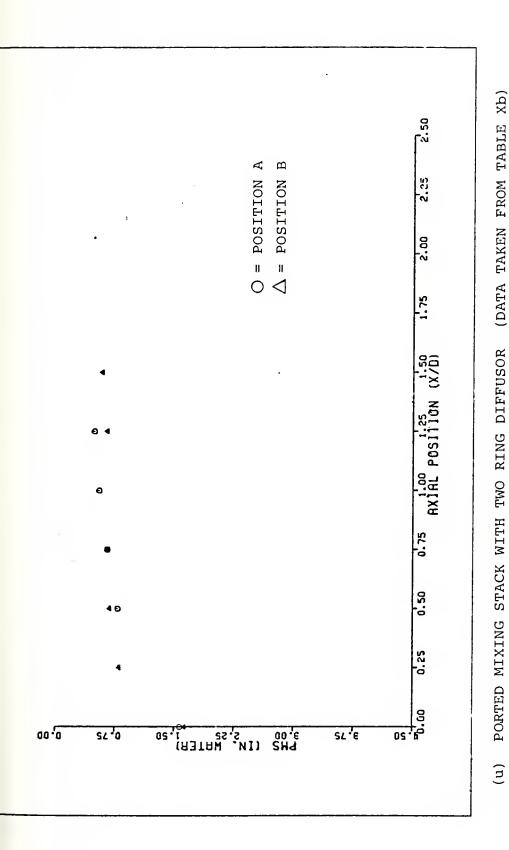
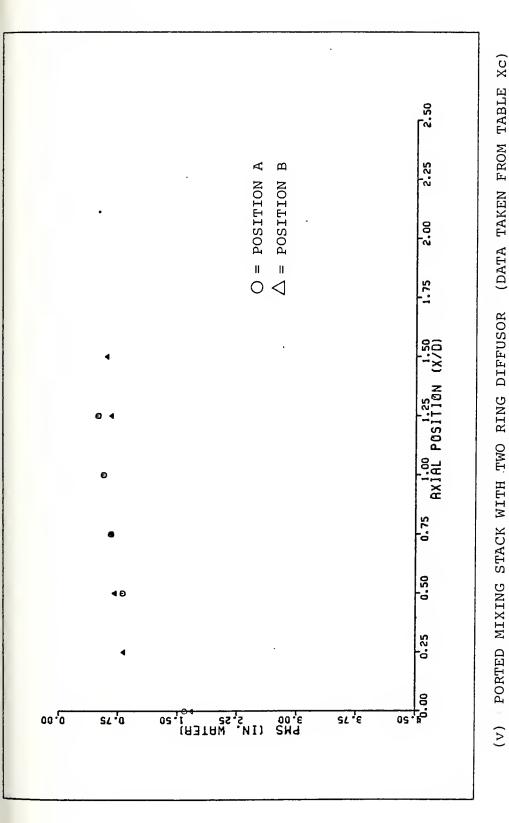


FIGURE 41 (CONTINUED)





(CONTINUED)

FIGURE 41



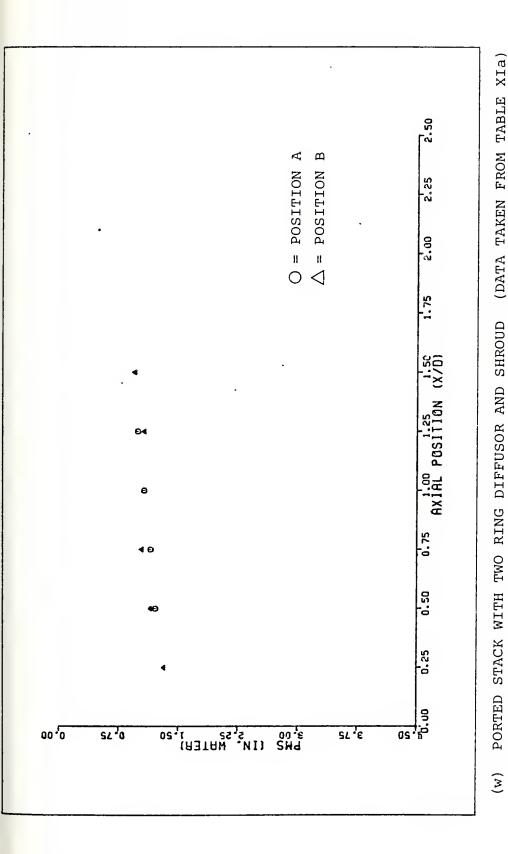
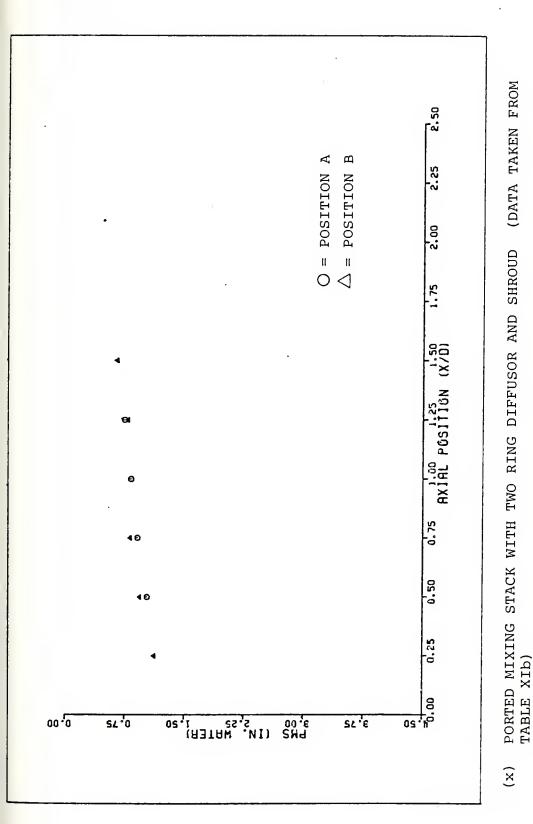


FIGURE 41 (CONTINUED)

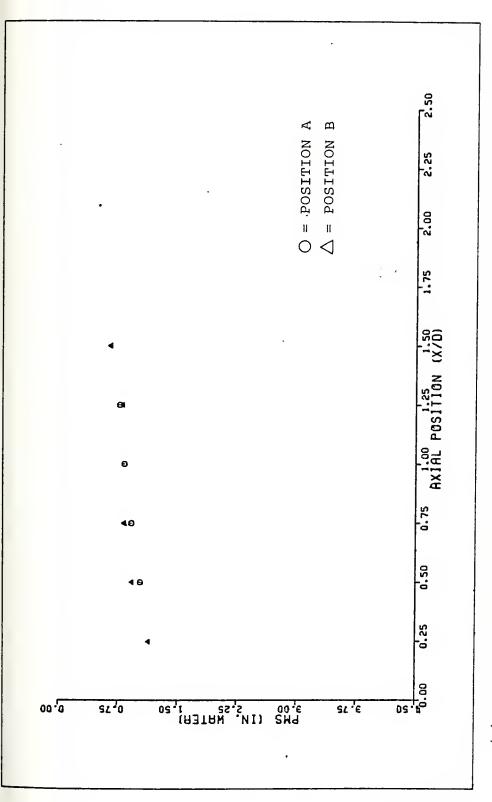




(CONTINUED)

FIGURE 41

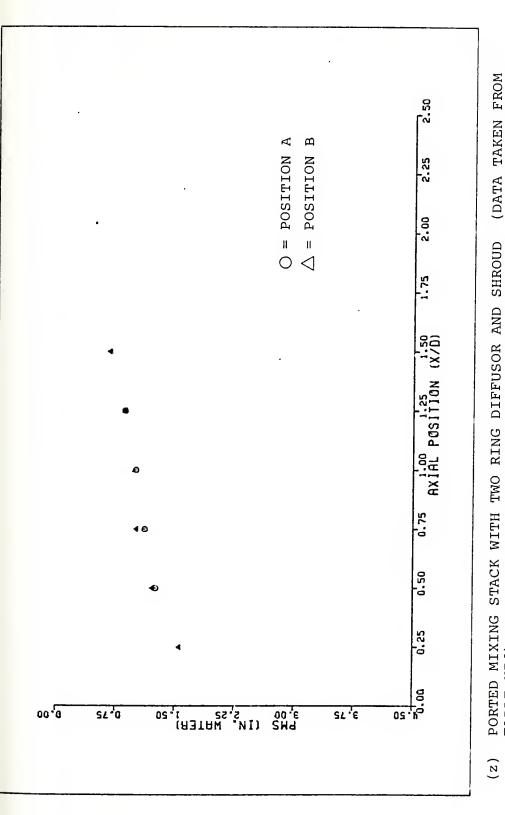




PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD (DATA TAKEN FROM TABLE XIC) (Y

FIGURE 41 (CONTINUED)

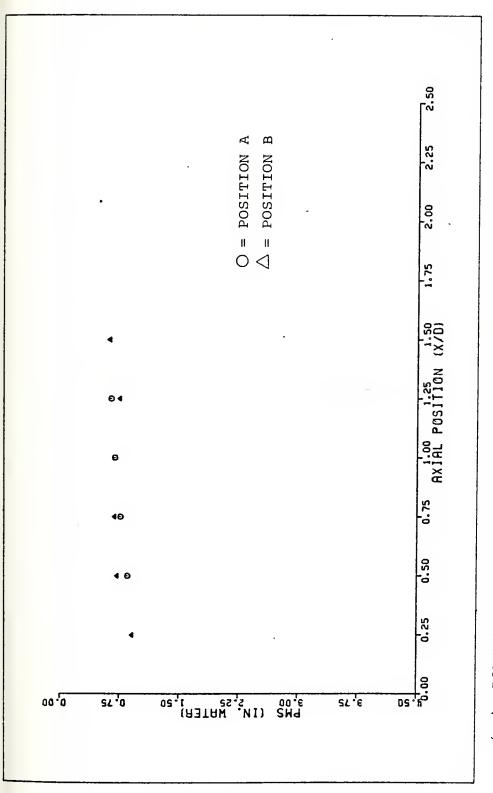




PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD TABLE XIA)

FIGURE 41 (CONTINUED)

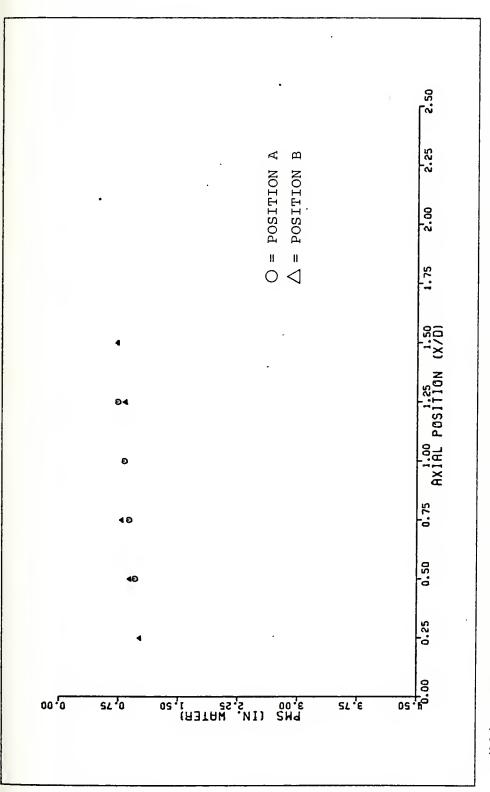




(DATA TAKEN FROM PORTED MIXING STACK WITH. TWO RING DIFFUSOR AND SHROUD TABLE XIIc) (aa)

FIGURE 41 (CONTINUED)

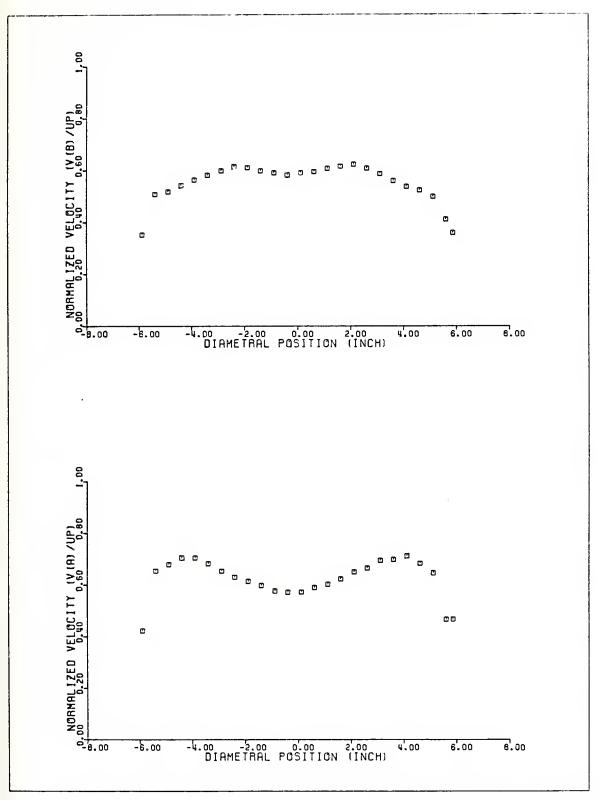




PORTED MIXING STACK WITH RING DIFFUSOR AND FLOW-THROUGH SHROUD (DATA TAKEN FROM TABLE XIIIC) (qq)

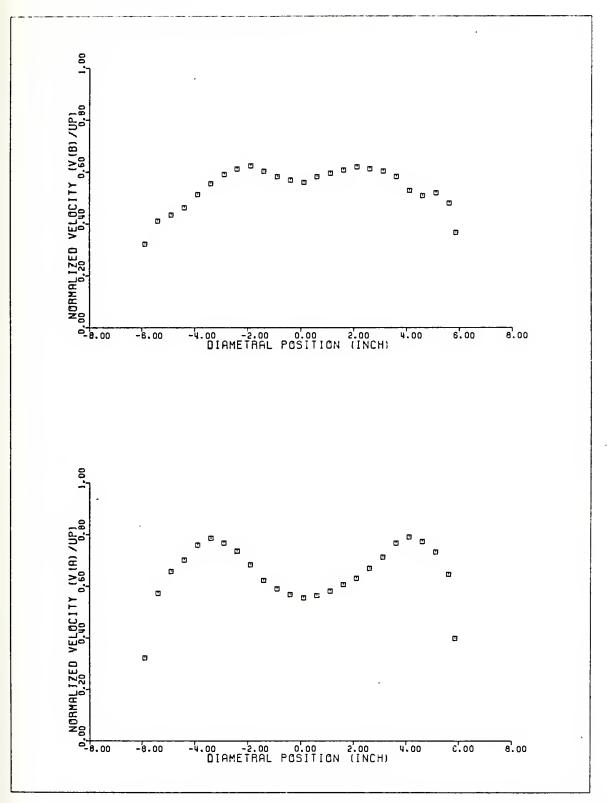
FIGURE 41 (CONTINUED)





(a) STRAIGHT MIXING STACK, L/D = 3.0 (DATA TAKEN FROM TABLE XIVa) FIGURE 42. EXIT VELOCITY PLOTS, TRAVERSE POSITIONS A AND B

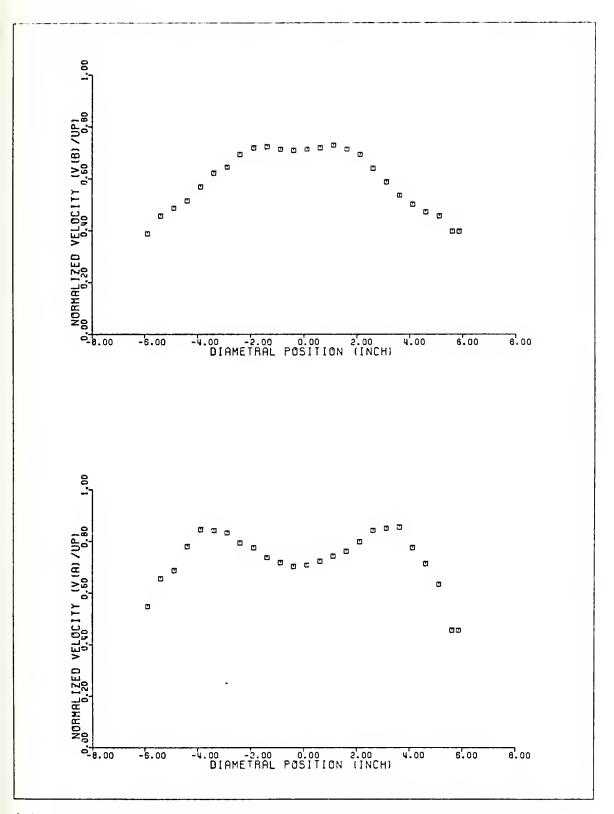




(b) STRAIGHT MIXING STACK, L/D = 2.5 (DATA TAKEN FROM TABLE XIVb)

FIGURE 42 (CONTINUED)

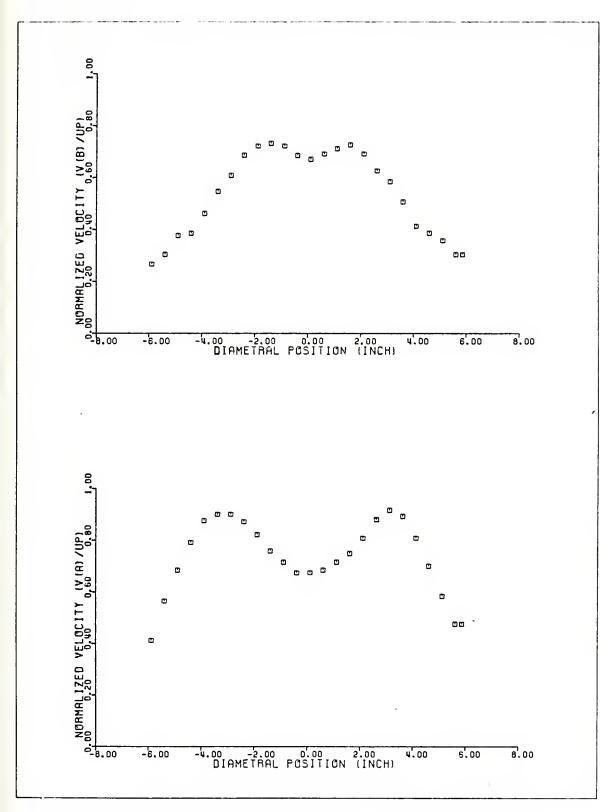




(c) STRAIGHT MIXING STACK, L/D = 2.5 (DATA TAKEN FROM TABLE XVa)

FIGURE 42 (CONTINUED)

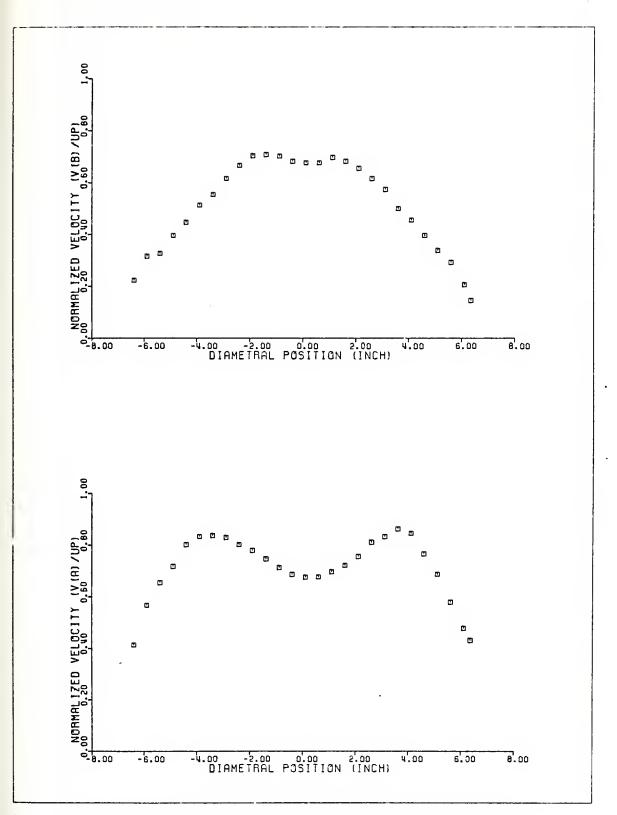




(d) STRAIGHT MIXING STACK, L/D = 1.75 (DATA TAKEN FROM TABLE XVb)

FIGURE 42 (CONTINUED)

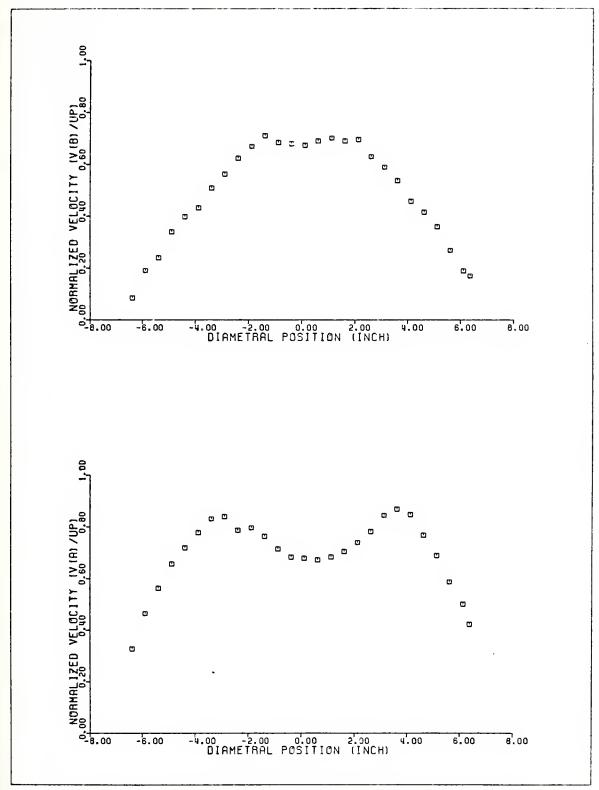




(e) STRAIGHT MIXING STACK WITH 7 DEGREE SOLID DIFFUSOR (DATA TAKEN FROM TABLE XVIa)

FIGURE 42 (CONTINUED)

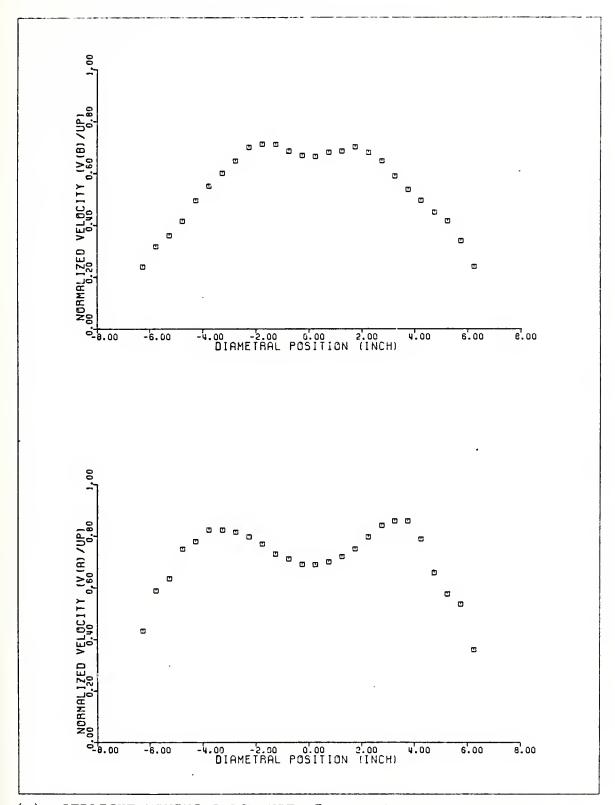




(f) STRAIGHT MIXING STACK WITH 7 DEGREE SOLID DIFFUSOR (DATA TAKEN FROM TABLE XVIb)

FIGURE 42 (CONTINUED)

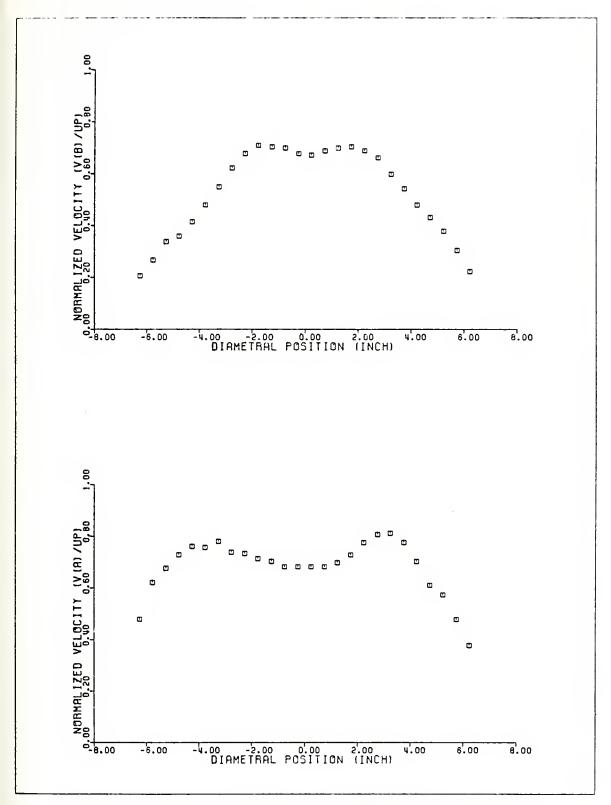




(g) STRAIGHT MIXING STACK WITH 7 DEGREE SOLID DIFFUSOR (DATA TAKEN FROM TABLE XVIC)

FIGURE 42 (CONTINUED)

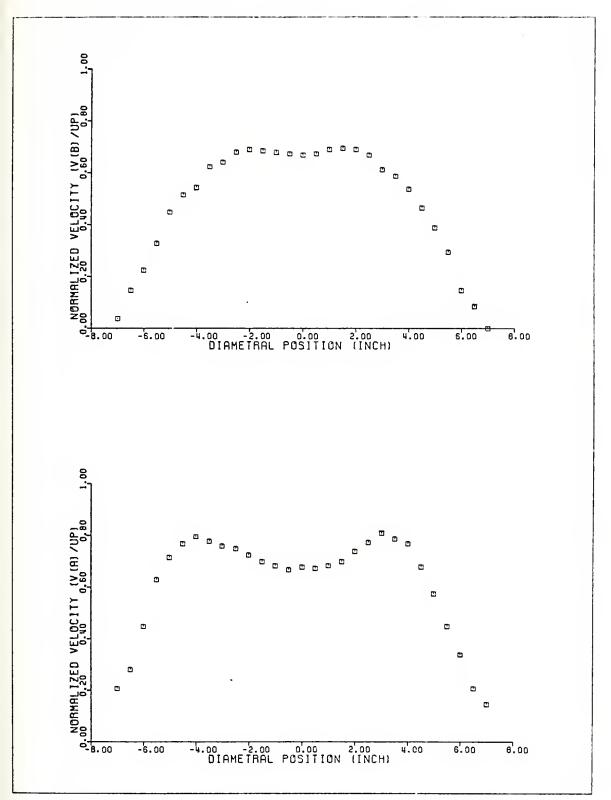




(h) STRAIGHT MIXING STACK WITH 7 DEGREE SOLID DIFFUSOR (DATA TAKEN FROM TABLE XVId)

FIGURE 42 (CONTINUED)

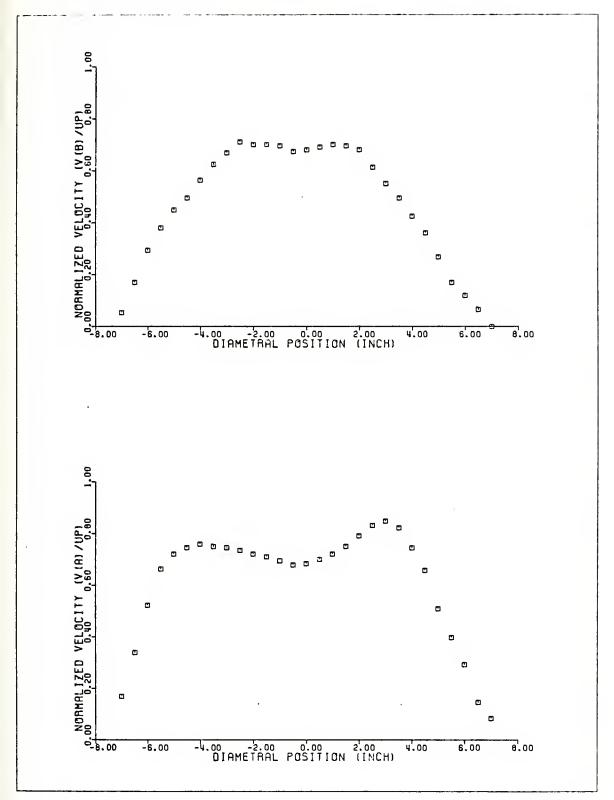




(i) MIXING STACK WITH TWO RING DIFFUSOR (DATA TAKEN FROM TABLE XVIe)

FIGURE 42 (CONTINUED)

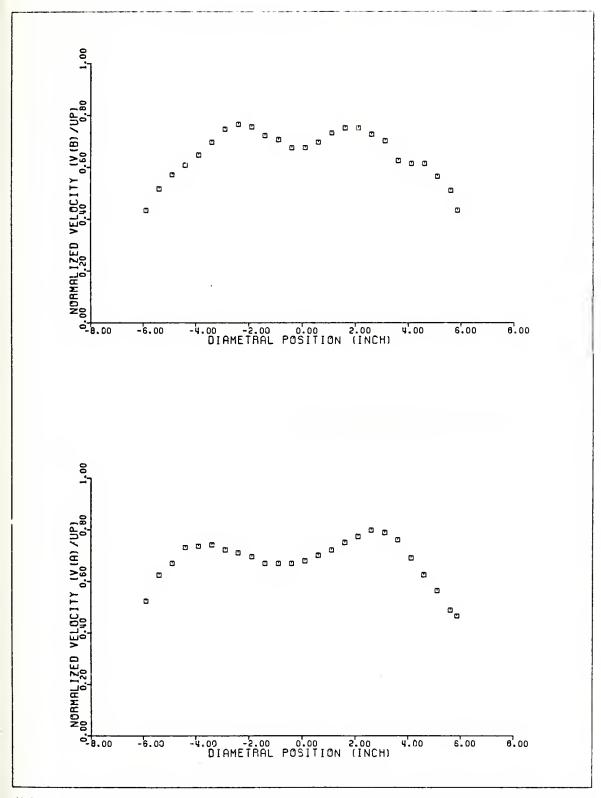




(j) MIXING STACK WITH THREE RING DIFFUSOR (DATA TAKEN FROM TABLE XVIf)

FIGURE 42 (CONTINUED)

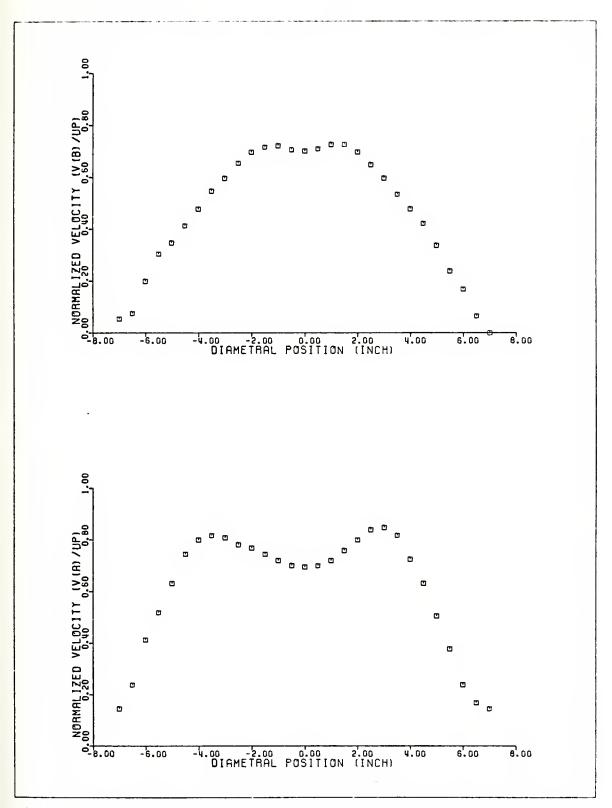




(k) PORTED MIXING STACK (DATA TAKEN FROM TABLE XVII)

FIGURE 42 (CONTINUED)

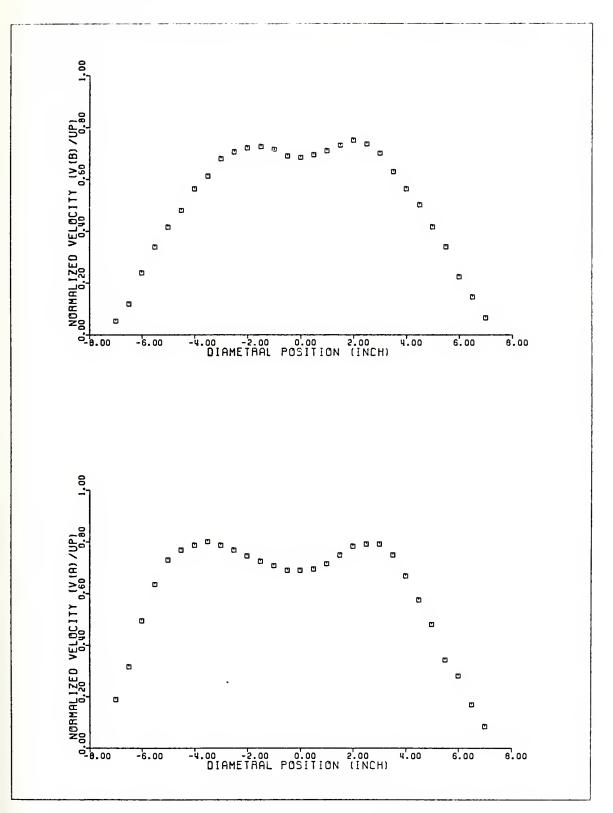




(L) PORTED MIXING STACK WITH TWO SOLID DIFFUSOR RINGS (DATA TAKEN FROM TABLE XVIII)

FIGURE 42 (CONTINUED)

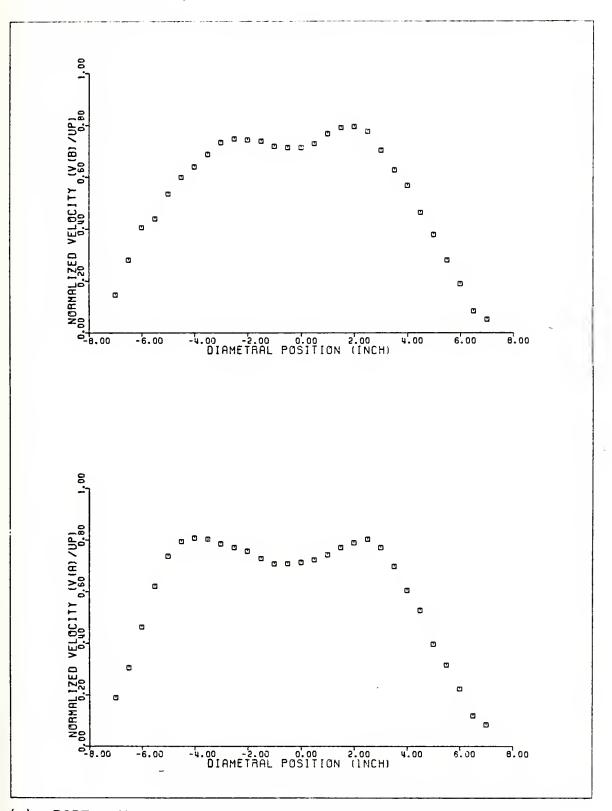




(m) PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD (DATA TAKEN FROM TABLE XIXa)

FIGURE 42 (CONTINUED)

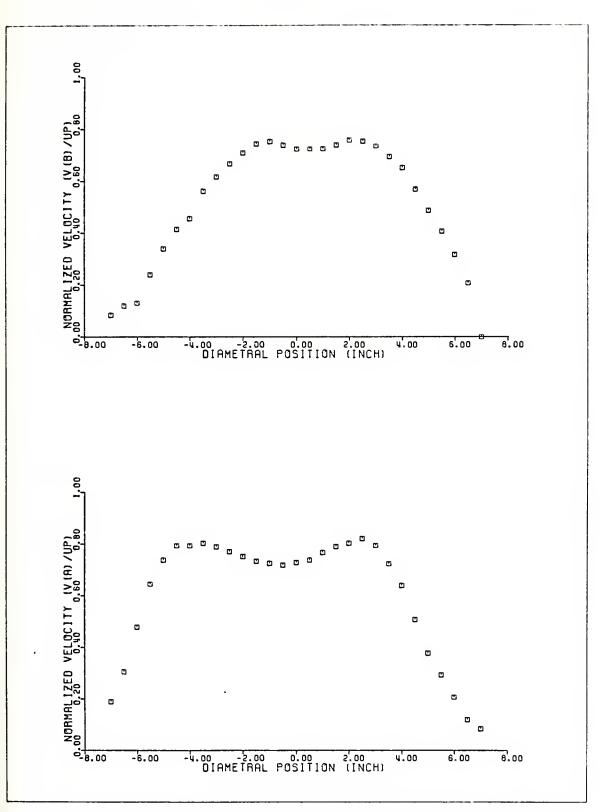




(n) PORTED MIXING STACK WITH TWO RING DIFFUSOR AND SHROUD (DATA TAKEN FROM TABLE XIXb)

FIGURE 42 (CONTINUED)





(o) PORTED MIXING STACK WITH RING DIFFUSOR AND FLOW-THROUGH SHROUD (DATA TAKEN FROM TABLE XIXC)

FIGURE 42 (CONTINUED)



UPTAKE BACK PRESSURE	Significant decrease with decrease in area ratio	No effect	Slight decrease with respect to a straight stack of equal L/D	Slight increase with respect to solid diffusor and straight stack of equal L/D	Slight increase with respect to solid diffusor and straight stack of equal L/D	Similar to ported stack	Similar to ported stack
FILM COOLING	Not applicable	Not applicable	Not applicable	Not applicable	Film cooling introduced	Similar to ported stack without diffusor	Significantly increased
MIXING	Slight decrease with decrease in area ratio	Improved with L/D increase from 1.75 to 3.0	Slight decrease with respect to a straight stack of equal L/D	No significant change from solid diffusor	Similar to straight stack with equal L/D	Similar to split ring diffusor	Improved with respect to split ring diffusor
PUMPING	Decreases with a decrease in area ratio	Improved with L/D increase from 1.75 to 3.0	Improved performance with respect to a straight stack of equal L/D	Improved with respect to a straight stack of equal L/D	Similar to straight stack with equal L/D	Similar to straight stack with equal L/D	Similar to shrouded stack with reduced tertiary pumping
SYSTEM NODIFICATION	Area Ratio (A _M /A _p) Decrease (Increase in Primary Flow Nozzle Diameter)	Changing Mixing Stack Length (L/D)	Solid Diffusor	Split Ring Diffusor	Film Cooling Ports	Shroudea Mixing Stack with Split Ring Diffusor	Flow-Through Shroud and single-Ring Diffusor

TABLE I. SUMMARY OF EFFECTS OF PARAMETERS



SUMMARY OF EDUCTOR SYSTEM PERFORMANCE CRITERIA FOR EDUCTOR SYSTEMS TESTED TABLE II.



Radial Position L/D					
	a	1.15	1.18	1.20	1.20
0.500	b	1.18	1.21	1.19	1.20
	С	1.28	1.29	1.23	1.21
	a	1.10	1.15	-	-
0.625	b	1.13	1.18	-	-
	С	1.26	1.23	-	-
	a	1.06	1.06	1.03	1.06
0.750	b	1.08	1.09	0.99	1.08
	С	1.15	1.18	1.03	1.09
	a	1.00	0.99	-	-
0.875	b	0.99	1.01	-	-
	С	1.10	1.12	-	-
	a	0.93	0.89	0.92	0.88
1.00	b	0.93	0.94	0.89	0.86
	С	1.01	1.01	0.94	0.91

Run a: data taken with mixing stack in true alignment.

Run b: data taken with mixing stack 0.97 degrees out of alignment.

Run c: data taken with mixing stack 3.42 degrees out of alignment.

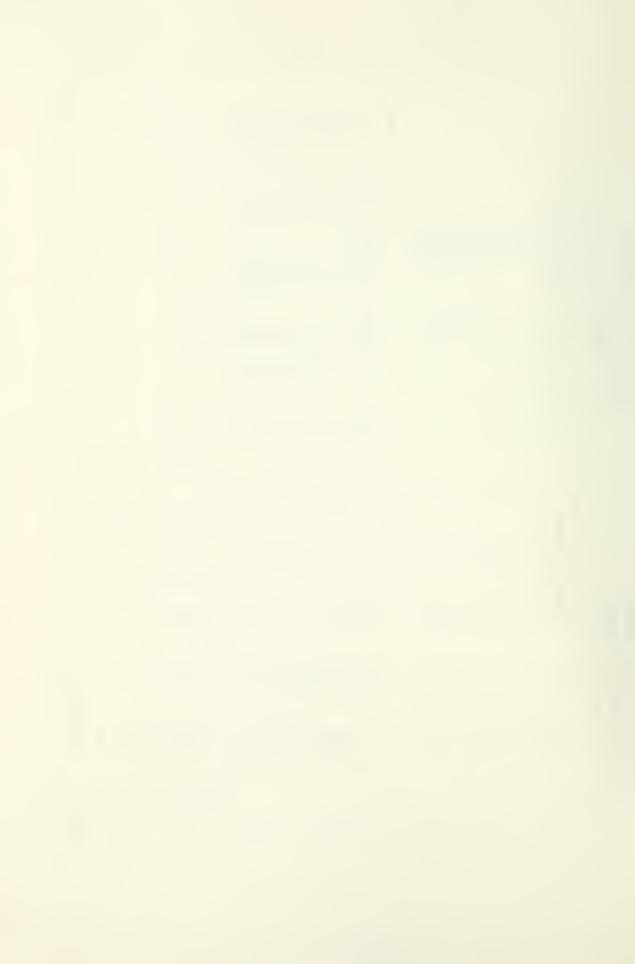
All data recorded in H20.

TABLE III. MIXING STACK PRESSURE READINGS AS EFFECTED BY ALIGHMENT



	NUVEER	NUPEER OF PRIMARY	NCZZLES	47 (LPTAKE CLAMETER: 11.50 INCHES	HETER: 11	.50 INCHES		
THE THE TABLE TO THE TABLE TO THE TABLE TO THE TOTAL T	741714	יו מסינה יני	#FEICH:	מיינות מי	ŝ			AKER KA 110		3.00		
FIGH LATE AND LATE AN	941414		NETER SOLL	JACFES OF OF				CKIFICE UI	ANEIEK:	E.502 INCHES		
	747.4 747.4	יייייייייייייייייייייייייייייייייייייי	ire 160. 11.	TO THE S				ואויורב מב	-			
The Capta	94 I x I 4	STACK L/I						AMBIENT PR		20.12 INCHES	9	
Note	~	FCR	CPCR	TCR	TLPT	TAVE	PU-FA	5 d- V d	PA-FNZ	SECCADAFY	ARE !	
0.7 21.2 55.0 112.0 66.0 4.60 4.5f 4.51 0.0 0.0 0.0 0.1 12.56 0.0 0.1 12.56 0.0 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2	RUN	INCHES OF		OEGR	EES FA"REI	NFEIT	INC	HES OF LAT	ER	SCUARE 1NC	FES	
0.7 21.2 55.0 112.0 64.0 5.50 3.25 2.24 12.36 12.36 0.07 0.1 21.1 60.0 112.0 66.0 6.55 2.34 2.23 2.33 25.133 0.0 1.1 2.0 0.1 2.0 0.0 1.35 0.0 1.35 0.0 1.35 0.0 1.35 0.0 1.35 0.0 1.3 0.0 0.0 1.3 0.0 0.0 1.3 0.0 0.0 1.3 0.0 0.0 1.3 0.0 0.0 1.3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0		0.7	.11·3	5E.0	112.0	0.99	4. 60	4.50	4.51	0.0		
0.7 21.1 60.0 112.0 66.0 6.25 2.34 2.33 25.123 0.7 20.9 59.0 112.0 66.0 7.00 1.35 1.24 5.25 0.7 20.9 59.0 112.0 66.0 7.00 1.35 1.24 5.265 0.7 20.8 59.0 112.0 66.0 7.00 0.35 0.36 100.521 0.7 20.8 59.0 112.0 66.0 7.00 0.35 0.36 100.521 0.7 20.8 60.0 114.0 66.0 8.10 0.12 0.13 0.13 2.01.06 0.7 20.8 60.0 114.0 66.0 8.10 0.12 0.13 0.13 2.01.06 0.7 20.8 60.0 114.0 66.0 8.10 0.12 0.13 0.13 2.01.06 0.7 20.8 60.0 114.0 66.0 8.10 0.12 0.13 0.13 0.13 0.16 0.7 20.8 60.0 114.0 66.0 8.10 0.12 0.13 0.13 0.13 0.13 0.16 0.0 0.1 20.0 0.14 0 0.14 0 0.14 0 0.14 0 0.12 0.13 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14	2	0.7	21.3	25.0	112.0	66.0	5.50	3.25	2.24	12.56	9	
0.7 20.9 59.0 112.0 66.C 7.00 1.35 1.24 56.265 0.13 20.8 55.0 113.0 66.C 7.00 0.56 0.56 100.521 0.14 20.6 55.0 113.0 66.C 7.00 0.56 0.56 100.521 0.15 20.6 55.0 113.0 66.C 7.05 0.25 0.25 150.796 0.17 20.6 64.0 114.0 66.C 8.10 0.15 0.16 201.06 0.19 20.6 64.0 114.0 66.C 8.10 0.15 0.16 201.06 0.10 20.6 64.0 114.0 66.C 8.10 0.15 0.16 201.06 0.10 20.7 20.8 64.0 114.0 66.C 8.10 0.12 0.18 248.184 14*	e	1.0	21.1	0.03	112.0	0.99	6.25	2.34	2.33	25.13	ίψ.	
0.7 20.8 55.0 113.0 66.C 7.70 0.56 0.56 100.521 0.7 20.6 55.0 111.0 66.C 7.95 0.25 0.25 150.794 0.7 20.6 55.0 111.0 66.C 7.95 0.25 150.794 0.7 20.6 6.0 114.0 66.C 8.10 0.11 0.13 201.062 0.7 20.7 60.0 114.0 66.C 8.10 0.12 0.13 201.062 0.7 20.7 60.0 114.0 66.C 8.10 0.12 0.13 201.062 0.7 20.7 60.0 114.0 66.C 8.15 0.12 0.13 201.062 0.8 114.0 66.C 8.15 0.12 0.12 0.12 0.12 0.13 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1	4	1.0	50.9	29.0	113.0	96.6	7.00	1.35	1. 34	56.26	2	
0.7 2 € 6.6 55.0 112.0 6 € 6.C 7.95 0.25 0.25 150.79¢ 0.7 2 € 6.0 114.0 6 € 6.C 8.0 0.15 0.13 0.13 249.18¢ 0.1 2 € 6.0 114.0 6 € 6.C 8.10 0.13 0.13 249.18¢ 0.1 2 € 6.0 114.0 6 € 6.C 8.10 0.13 0.13 249.18¢ 0.1 2 € 7.1 60.0 114.0 6 € 6.C 8.10 0.12 0.13 249.18¢ 0.1 2 € 7.1 60.0 114.0 6 € 6.C 8.10 0.12 0.13 0.13 249.18¢ 0.1 2 € 7.1 60.0 114.0 6 € 7.0 8.15 0.12 0.12 0.13 1.0 0.10 0.12 0.12 0.13 0.13 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.14	5	0.1	20.8	95.0	113.0	9.99	7.70	0.56	0.56	100.53	-	
0.17 2(.6) 61.0 114.0 66.C 81.0 0.15 C.1E 201.062 0.17 2(.8) 60.0 114.0 66.C 81.0 0.13 249.186 0.17 2(.8) 60.0 114.0 66.C 81.0 0.13 249.186 0.18 20.1	9	0.7	20.6	98.0	112.0	96.6	7.95	0.25	0.25	150.79	ę	
0.17 2C.68 60.0 114.0 66.C 8.10 0.13 248.18€ 0.18 114.0 66.C 8.10 0.012 0.012 0.013 248.18€ 1.8	7	6.0	2 (•5	61.0	114.0)* 99 ·	8.00	0.15	0.16	201.06	14	
0.1 2 C.7 60.0 114.0 6 €.C 8.15 0.CC C.CC ************************************	80	0.7	26.8	Ò•09	114.0	J. 99	8.10	0.13	0.13	248.18	ţ	
He	σ	0.1	20.7	0.09	114.0	9.39	8.15	0.00	22.5	***		
C C C C C C C C C C C C C C C C C C C	~	* 3	i	*	p*/1*	77.44.I*R	Ą	S	ځ	Š	חח	LFT MACH
0.25£7 0.2124 (5.195 0.3411 0.2027) 2.4€9 0.0 214.53 71.62 71.15 0.2103 0.2124 (5.195 0.3411 0.2027) 2.4€9 0.0 213.6€ 85.01 73.63 0.22£7 0.2254 0.5195 0.2455 0.2455 0.3457 3.670 1.317 211.0€ 93.07 72.25 0.5462 0.1235 0.5179 0.1455 0.1526 3.6€7 1.577 210.12 15.5€ 72.52 0.7066 0.6554 0.5179 0.0402 0.6€65 3.647 2.577 210.12 115.5€ 72.52 0.7066 0.6554 0.5179 0.0319 0.7320 3.637 210.12 115.5€ 72.52 0.7066 0.6554 0.5179 0.0319 0.7320 3.647 2.577 210.12 115.5€ 72.52 0.7066 0.6554 0.5179 0.0319 0.7320 3.647 2.577 210.12 115.5€ 72.52 0.7061 0.6193 0.5163 0.0210 0.7152 3.644 3.611 210.06 122.21 72.22 0.7062 0.5163 0.5163 0.0005 ******* 2.422 ****** 2.65.5 ****** 72.52 11CK FRESCURE LISTRIBUTION FCR RUN: 9 PCSITION A 0.0 0.50 1.420 0.820 0.365 0.265 0.260 (a) L/D = 3.0, Run 1 1.507 0.500 1.500 0.890 0.445 0.222 0.060 0.200 1.320 0.890 0.445 0.222 0.000 0.201 0.132 0.089 0.045 0.022 0.000	RUN						LEMISEC	L PM / S EC	F1/5EC	FT/SEC	FT/SEC	
C-2103 O-312¢ C-519\$ O-3411 O-2027 3-670 1-317 213-6¢ 95-07 73-25 O-25¢7 O-225¢4 O-519\$ O-245\$ C-3457 3-670 1-317 211-9¢ 93-97 72-25 O-56¢2 O-123\$ O-617\$ O-66¢5 3-6¢7 3-6¢7 2-577 211-02 15.5¢ 72-5¢ C-706¢ O-655¢4 O-6179 O-0603 O-66¢5 3-6¢7 2-577 210-12 15.5¢ 72-6 C-706¢ O-655¢4 O-6179 O-0732 O-66¢5 3-6¢4 3-617 208-28 72-6 C-8100 O-6193 O-6163 O-0755 2-6¢4 3-611 210-06 72-5 C-8100 O-6163 O-000 O-7552 2-6¢4 3-611 210-06 72-5 C-826¢ O-6163 O-6163 O-7552 2-6¢4 3-611 210-06 72-5 C-826¢ O-6163 O-6163 O-6163 O-7552 2-6¢4 3-611 <td>1</td> <td>0.0</td> <td>6.4368</td> <td>0.5195</td> <td>0.4685</td> <td>0.0</td> <td>3.654</td> <td>0.0</td> <td>214.53</td> <td>71.62</td> <td>74.13</td> <td>6.063</td>	1	0.0	6.4368	0.5195	0.4685	0.0	3.654	0.0	214.53	71.62	74.13	6.063
0.25£7 0.2544 0.5195 0.2455 0.3457 3.670 1.317 211.9£ 93.97 72.25 0.5462 0.1335 0.5179 0.1455 0.5260 3.656 1.597 211.C3 155.65 72.52 0.5462 0.1335 0.5179 0.0403 0.6655 3.647 2.577 210.12 115.56 72.60 0.7611 0.6293 0.5179 0.0319 0.7320 3.637 2.763 208.57 118.47 72.21 0.0406 0.6594 0.5179 0.0319 0.7320 3.634 2.763 208.57 118.47 72.21 0.05610 0.6193 0.5163 0.0210 0.7552 2.644 3.611 210.06 122.21 72.60 0.7611 0.6293 0.5163 0.0005 ******** 2.652 2.66.38 121.17 72.60 0.7611 0.6293 0.5163 0.0005 ******** 2.652 2.64 3.611 210.06 122.21 72.60 0.7611 0.6293 0.5163 0.0005 ******** 2.652 2.60 2.60 2.50 2.60 2.50 2.60 2.60 2.60 2.60 2.60 2.60 2.60 2.6	2	C.2103	0.3136	C.5195	0.3411	0.2627	3.651	6.176	213.66	85.C1	73.63	0.063
0.5662 0.1335 0.5179 0.1455 0.1220 3.656 1.557 211.C3 1C5.65 72.52 C.7066 0.0554 0.5179 0.0602 0.066C5 3.647 2.577 210.12 115.58 72.60 0.7061 0.0293 C.5179 0.0319 0.7320 3.634 2.577 210.12 115.58 72.60 0.7011 0.0293 C.5179 0.0319 0.7320 3.634 2.527 208.38 121.17 72.00 0.7011 0.0293 C.5179 0.0319 0.7752 2.644 3.011 210.06 122.21 72.52 1.6264 3.0125 0.5163 0.0005 ******* 2.625 2.644 3.011 210.06 122.21 72.52 1.026 0.5163 0.0005 ******* 2.625 ****** 2.625 0.5163 0.0005 ******* 2.625 ******* 72.25 1.00 0.50 0.50 0.50 0.50 0.50 0.50 0.5	m	0.2567	0.2254	0.5195	0.2455	0.3457	3.670	1.317	36.115	53.97	73.25	C. C € 2
C.7066 0.0554 0.5179 0.0603 0.6665 3.647 2.577 210.12 115.58 72.40 0.7611 0.0293 C.5179 0.0319 0.7320 3.637 2.763 208.57 118.47 72.21 C.8100 0.0193 0.5163 0.0210 0.7755 2.644 3.011 210.06 122.21 72.02 C.8264 0.0125 0.5163 0.0005 ******* 2.625 2.644 3.011 210.06 122.21 72.02 C.8264 0.0125 0.5163 0.0005 ******* 2.625 ******* 72.55 ********* C.CC05 0.5163 0.0005 ******* 2.625 ******* 72.55 ******** C.CC05 0.5163 0.0005 ******* 2.625 ******* 72.55 ******** C.CC05 0.5163 0.0005 ******* 2.625 ******* 72.55 ******** C.CC05 0.5163 0.0005 ******* 2.625 ******* 72.55 ********* C.CC05 0.5163 0.0005 0.0005 ******* 72.55 ******** C.CC05 0.0005 0.0005 0.0005 ******* 72.55 ********* C.CC05 0.0005 0.0005 0.0005 ******* 72.55 ********* C.CC05 0.0005 0.0005 0.0005 0.0006 0.0005 0.0006	4	0.5462	0.1335	0.5179	0.1455	0.53.0	3.656	1.557	211.03	165.65	72.52	0.062
0.7611 0.6293 6.5179 0.0319 0.7320 3.63 208.57 118.47 72.21	٧٥	C.7066	0.0554	0.5179	0.0603	0.6605	3 a647	2.577	\$10.15	115.58	72.60	0.062
C.8100 0.C193 0.5163 0.0210 0.7755 3.614 2.527 208.38 121.17 72.C0 C.8264 0.C125 0.5163 C.C136 0.7552 2.644 3.C11 210.06 123.21 72.55 ***********************************	•	0.7611	0.0293	C.5179	0.0319	0.7320	3. 630	2.763	208.57	118.47	72.21	3.062
C.8264	١	C.8100	0.0193	0.5163	0.0210	0.1755	3.614	2.527	208.38	121.17	72.CO	0.041
******* (.CCO5 0.5163 0.0005 ******* 2.625 ****** 72.25 TICK FRESSURE CISTRIBUTION FCR RUN: 9 PCSITION A 0.0 0.50 1.420 0.820 0.365 0.200 2.50 (a) L/D = 3.0, Run 1 3.500 1.420 0.820 0.365 0.200 0.005 0.251 (.143 0.082 0.037 (.C2C 0.005) 1.0CK PRESSURE CISTRIBUTION FCR RUN: 9 POSITION B 0.0 0.50 1.00 1.5C 2.00 2.50 2.600 1.320 0.890 0.445 0.222 0.060 0.261 C.132 0.089 0.045 0.022 0.006	89	C.8264	3.0125	0.5163	C.C136	0.7552	3.644	3.011	210.06	123.21	72.55	0.062
11CK FRESSURE EISTRIBUTION FOR RUN: 9 PGSITION A 0.0 0.50 1.420 0.820 0.265 0.200 2.50 (a) $L/D = 3.0$, Run 3.500 1.420 0.820 0.265 0.200 0.050 0.251 0.143 0.082 0.037 0.020 0.005 1ACK PRESSURE CISTRIBUTION FOR RUN: 9 POSITION B 0.0 0.50 1.60 1.50 2.50 2.600 1.320 0.890 0.445 0.222 0.060 0.261 0.132 0.089 0.045 0.022 0.006		*******	(*(00)	0.5163	0.0005	****	3.625	***	265.50	***	72.35	0.062
0.0 0.50 1.0C 1.50 2.00 2.50 (a) L/D = 3.0, Run 3.500 1.420 0.820 0.265 0.200 0.0000 0.251 (.142 0.082 0.037 0.020 0.0000 0.0000 0.0000 0.0000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	PIXING S	TICK FRES	SURE CISTR	BUTICN FC			۷ 2					
3.500 1.420 0.820 0.265 0.2(C 0.050)) / C 3		03.0	1.00	1.50		2.50		11	Run	,	
14CK PRESSURE CISTRIBUTION FOR RUN: 9 POSITION 0.0 0.50 1.00 1.5C 2.00 2 2.600 1.320 0.890 0.445 0.222 0.261 C.132 0.089 0.045 0.022	SOLA - ALDS		1.420	0.820	0.365	0.266	0.050				,	
1ACK PRESSURE CISTRIBUTIEN FCF RUN: 9 POSITION 0.0 0.50 1.00 1.00 1.5C 2.00 2 2.600 1.320 0.890 0.445 0.222 0.261 C.132 0.089 0.045 0.022	FPS44		(.143	0.082	0.037	(.(2(0.005					
0.0 0.50 1.00 1.5¢ 2.00 2 2.600 1.320 0.890 0.445 0.222 0.261 0.132 0.089 0.045 0.022	FIXING :	TACK PRESS	SURE CISTR	IBUTICN FC			60 Z					
2.600 1.320 0.890 0.445 0.222 0.261 0.132 0.089 0.045 0.022)/C:		0.50	. 00.1	1.50		2.50					
0.261 C.132 0.089 0.045 0.022	11 1N - F2C)			0.890	0.445	0.222	090.0					
	F. S.		C-132	0.089	0.045	0.022	900.0					

PERFORMANCE DATA FOR STRAIGHT MIXING STACKS WITH PRIMARY NOZZLE DIAMETER OF 3.38 IN. TABLE IV.



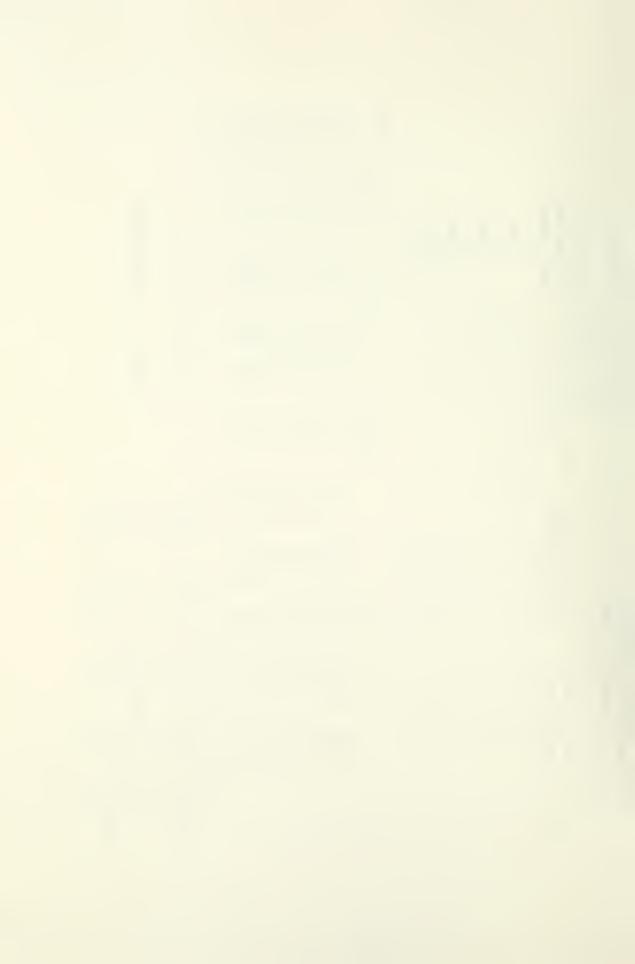
7.17.71											
MINING	MIXING STACK LEN	I H	INCFES				ORIFICE DIAMETER: OBLIFICE SETA: 0.457	PETEF: A	6.902 INCHES		
MIXING	MIXING STACK L/C	C: 3.00					AMEIENT PRESSURE:		29.87 INCHES HG	9	
z	FCR	CPGR	TOR	TLPT	TAP8	₩3-0d	5 d-4 d	FA-FA2	SECCNEARY AREA	AREA	
PUN	INCHES OF	WATER	DEGR	DEGREES FAFRENFEIT	NFEIT	IN	INCHES OF MATER	α	SCUARE INCHES	FES	
	7.0	22.4	55.0	10 6 • 0	3.99	4.90	4. EC	4.80	0.0		
2	1.0	22.0	55.0	106.0	9.99	5.85	3.40	3.39	12.566	9	
Э	7 • 0	21.5	55.0	106.0	J• 99	6.50	2.50	2.50	25.133	m	
4	7.0	21.8	54.0	106.0	9.39	7.35	1.42	1.41	5C.265	2	
2	7.0	21.7	54.0	166.0	0.99	8.10	0.61	0.61	100.531	-	
4	0.7	21.6	53.0	106.0	0.99	8.35	0.32	0.32	150.756	9	
7	7.0	22.1	0.15	164.0	3.99	8.50	C.25	0.25	175.525	· ·	
8	C.1	22.1	0.15	166.0	0.99	8.55	0.16	0.16	226.155	•••	
5	۲٠)	22.1	54.0	106.0	9.39	8.70	0.01	0.01	****		
~	*	*	*_	P * / T *	h*T**.44	33	<u></u>	م	Š	1	UPT MACH
RLA						LBM/SEC	LEFISEC	F1/5EC	FT/SEC	FT/SEC	
1	٠.٥	0.4429	0.5293	0.4767	0.0	3.784	٥•١	215.35	73.24	75.61	0.065
17	0.2109	0.3217	0.5293	C.3462	0.2042	2.750	C-751	216.67	86.39	74.67	990.0
121	(,363(0.2387	0.9293	0.2568	C.3515	3.742	1.258	215.70	96.15	14.53	990.0
4	55750	C.1366	0.9293	0.14.3	0.5286	3.727	2.040	214.84	107,98	74.24	0.064
2	0.7156	0.0592	0.5293	0.0637	C.6570	3.728	2.684	213.92	119.11	73.52	0.063
9	C.7831	0.C312	0.5293	0.0336	0.7562	3.723	2.516	313.48	123.05	73.17	0.063
4	1661.0	3.6246	0.5326	0.0258	3. 1745	3.762	3.006	214.93	125.19	74.27	990.0
80	(.8227	0.(153	£ 625 °C.	0.0165	C.7966	3.759	3.092	215.43	126.88	74.44	0.064
*	******	0.00.0	C.5293	0.0010	****	3.762	****	215.56	****	14.45	0.064
FIXING S	PIXINC STACK PRESSURE DISTRIBUTION FOR RUN:	URE DISTRI	IBUTION FO		9 PCSITIGN A	A AS					
3/6:	J• J	0.50	1.00	1.50	2.00	2.50					
FP5(IN. H2C):	3.600	1.560	1.180	0.410	0.360	0.060	(b) L/D	Ш	3.0, Run	2	
£ Þ S • :	0.363	0.151	0.113	0. 056	0.034	0.00€					
PIXING S.	PIXING STACK PAESSLRE CISTRIBUTION FOR RUN:	LRE CISTR	BUTICN FC		9 P0S1710N	8 8		707	Contract Bigg		
13/4	0.0	0.50	1.00	1.50	2.00	2.50	IABLE		(CONTINUED)	_	
PPSCIN. H2C):	2.750	1.410	0.540	0.480	0.210	0.050					
S # S # 3	275)										



													UPT MACH		0.064	0.064	0.064	990.0	0.064	0.064	0.064	0.064	0.064								
	ΗĞ	RE!	ñ			_							ಕ	FT/SEC	15.71	75.35	75.21	75.03	74.55	74.86	74.84	55.42	74.87								
.50 INCPES 3.C0 6.5C2 INCHES	3C.C5 INCHES HG	SECCNCARY AREA	SCUARE INCHES	0.0	12.566	25.133	50.265	100.531	150.756	202.004	248.186	***	ž	F1/SEC	73.14	86.85	75.36	108.84	118.73	125.59	126.74	126.10	*****			3.0, Run 3		(CONTINIED)	, , , , , , , , , , , , , , , , , , , ,		
CIAMETEF: 11. 110. AP/AP: CIAMETER: 6	<u> </u>	FA-FA2	~	4 - 55	3.34	2.43	1.41	13.0	0.34	0.20	0.14	0.01	٩n	F1/SEC	215.10	218.17	217.67	21.7.12	216.50	216.65	216.58	217.01	216 67			II					
	CRIFICE BETA: 0.49 Ambient pressure:	34-7d	INCLES OF MATER	4.50	3.34	2.45	1.40	0.56	0.33	0.20	0.14	C.C1	SH	LEMISEC	0.0	C.761	1.333	2.627	2.582	5 2 5 4 5	3.035	3.102	***			(c) L/D		TARLE IV			
	0 4	PU-FA	INC	4.80	5.85	6.65	7 •50	8.20	8.45	8.50	8.60	8.73	35	LBM/SEC	3.36	3.724	2.727	3.725	3.732	3.732	3.7:2	3.725	3.733	•	2.50	0.035	0.003		2.50	0.035	0.003
		TAPE	VFE1T	74 °C	14.0	74.0	74.6	14.0	74.0	74.0	74.0	74°C	55° # # #4		0.0	0.2024	0.3457	0.5258	0.6688	7592.0	0.7863	0.6626	***	9 FCSITION A	2.00	0.157	0.015	9 POSITION B	2.00	0.155	0.015
E S		TLPT	DEGREES FARRENFEIT	116.2	115.5	116.9	117.2	116.7	116.4	116.4	117.1	116.7	*L/ *d		0.4585	0.3393	0.2484	0.1439	0.0571	0.0340	0.0201	0.0139	0.0010		1.50	0.430	0.041		1.50	0.500	0.048
3.38 INCHES	.7C 1NCHES	1CR	OEGR	64.2	62.6	64.5	0.59	63.0	63.1	63.1	64.5	62.7	*		0.5267	0.5272	0.\$256	0.5251	0.5259	0.9264	0.5264	0.5253	0.5259	PIXING STACK FRESSURE CISTRIBLTION FOR RUN:	1. C0	0.930	0.089	PIXING STACK PRESSURE CISTRIBUTION FOR RUNS	1.00	595°3	0.092
FN NC22LES: 4 CIAPETER: 3.38 IN NGTP: 35.10 INCHES	STACK CIAPETER: 11.7C INCHES	CFCR	MATER	1.55	22.0	22.0	22.0	22.0	22.0	22.0	22.1	22.0	ġ.		6525.0	0.3146	0.2299	0.1331	0.C529	C.(315	0.0186	0.C129	0.0010	UFE C151R	05.0	1.650	C-158	LAE CISTRI	05.3	1.410	C-135
NUPEER OF PRIMAF FILEFFY NO22LE E PIXING STACK LEN	STACK CLAPE STACK L/C:	FOR	INCHES OF	1.0	0.1	1.0	1.0	7.0	1.0	1.0	C.7	C.7	1		0.0	C.2C53	6.3576	0.5441	C. ES1 S	1351.0	0.8132	C. 8305	******	ACK FRESS	0.0	4.000	C.382	ACK PRESS	ر د. د	2.760	0.264
	917170	4	PUN	1	7	е	4	2	ç	7	80	5	z	RLA	1	2	"1	4	70	9	7	au au	6	PIXING ST	: 37 X	FPS(IA. F2():	F P. S. R.	PIXING ST	3,75:	FPS(IN. F2C1s	14541
																										Ţ				ů.	



											UPT MACH		0.064	9.064	0.064	0.064	9.064	0.064	0.064	0.064	790.0								
91	AREA.	2	9	C)	2	-	9	14	(F		3	FT/SEC	75.35	15, 10	74.87	74.76	14.69	74.46	74.55	74.63	74.41					UED)			
3.00 6.502 INCHES	SECCACARY AREA	SECARE INCHES	12.566	25.133	50.265	166.531	150.756	201.062	246.186	****	Š	F 1, SEC	72.80	86.43	95.51	108.27	111.54	121.31	125.36	126.52	****		7.5	i		(CONTINUED)			
FTER: 11. AP/AF: APETER: 6 AR C.457	FA-FN2	7 7	3.30	2.32	1.40	0.42	52.0	0.15	0.13	0.01	۳	FT/SEC	216.07	217.34	216.68	216.19	216.15	215.48	215.87	215.55	215.34		I./D =			E IV			
UPTAKE CIAMETER: 11.5C INCLES AREA RATIC, AP/AF: 3.00 CRIFICE CIAMETEF: 4.5C2 INCH CRIFICE BETA: C.457 AMEIENT PRESSURE: 20.C4 INCH	PA-FS	63 CF MA IE	3.30	2.33	1.37	C.42	52.0	0.15	C.13	C.02	V)	LEM/SEC	0.0	0.779	1.307	2.027	2.211	2.773	2.553	3.055	****		(ع)	(1)		TABLE			
> 4 U U 4	PU-FA	11 NI 7 7 7 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	5.85	6.60	7.50	8.30	8.45	8.55	8.60	8.7C	T.	LBY/SEC	3.757	3.757	3.740	3.759	3.768	3.760	3.766	3,745	3.7.5	⋖				æ			
	TAPE	76.6	70°C	76.07	70.0	7.0.C	76.0	70.0	70°C	70.0	h*T**.44		0.0	0.2009	0.3265	0225	0.5687	0.7148	0.1700	0.7656	******	9 PGS1110N	2.00	0.210	C. 020	9 POSITION	2.00	0.160	0.015
vii	TLP1 1A	110.1	110.1	109.2	169.4	109.3	165.0	105.2	105.1	105.5	P*/T*		0.4651	0.3345	0.2372	C-1402	0.0430	0.0258	0.0190	0.0133	C.0015		1.50	0.370	0.036		1.50	0.500	0.048
3.36 INCHES INCHES 70 INCHES	TCR	56.0	56.1	55.1	55.4	55,3	E	5.35	55.0	54.2	*		0.5296	0.5296	C.5311	0.5308	C • 9309	0.5214	0.5311	0.5313	9065.0	BUT JCN FC	1.00	0.880	0.084	RE CISTRIBUTION FOR RUN:	1.00	0.850	0.082
CF FRIPARY NC22LES: 4 NC22LE CIAMETER: 3.36 INCH STACK LENGTH: 25.25 INCHES STACK CIAMETER: 11.70 INCHES STACK L/C: 2.50	0FCR		22°C	22.0	0.55	22.1	22.0	1.55	22.1	22.0	.		0.4324	C-31C5	0.2205	0.1305	0.6400	0.0278	0.C177	0.C124	0.0014	MIXING STACK FRESSLRE CISTRIBUTION FOR RUN:	0.50	1.420	C-136	UPE CISTR	C.5C	1.190	C.114
ALPEER CF FRIPAFY NC22LES FFIPERY NC22LE CIAMETER: PIYING STACK LENGTH: 25.2 PIXING STACK CIAPETEF: 11 PIXING STACK L/C: 2.50	POR		0.7	6.7	7.0	1.0	1.0	C-3	1.0	0.1	*		0.0	C. 2075	C.3476	C.5352	5985*)	0.7375	9551.3	C-61C6	******	ACK FRESS	ပ • ပ	1.950	0.187	MIXING STACK FRESSU	0.0	2.240	0.215
ALPEER FRIPER FIXING FIXING FIXING	Z -		. 2	m)	4	u۱	9	7	w	v	۷	RLA	1	2	Э	4	wì	ę.	7	8	6	MIXING ST	:0/4	FPS(IN, 12C);	FM 54:	MIXING ST	3/E:	FPS(116. F2C):	2 R 5 A 3



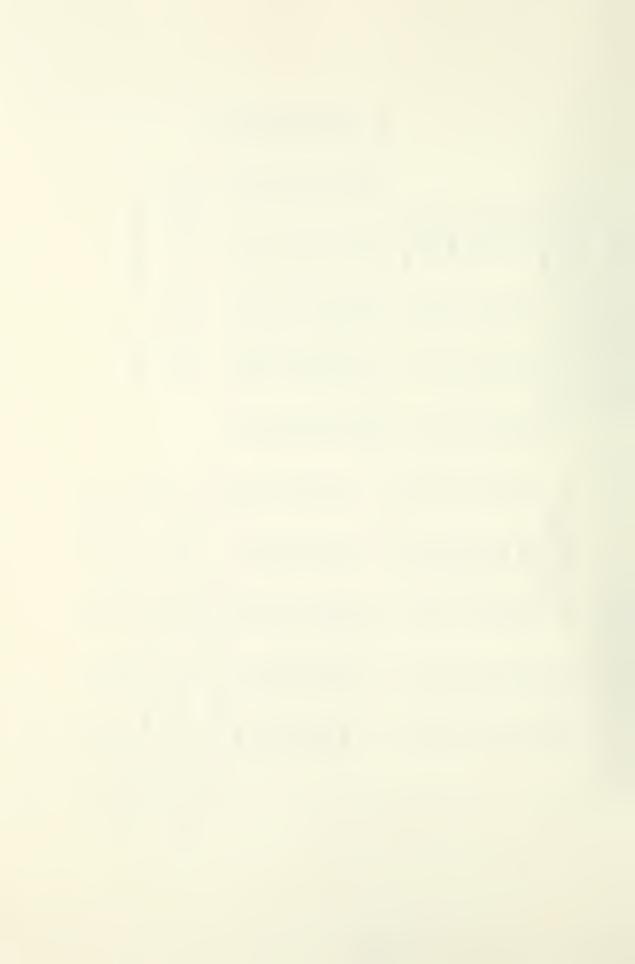
												UFT MACH		0.066	C. C.5	0.065	0.065	0.065	0.065	0.065	0.065	0.065
o T	AR E.A	Ê		41	•	u,			64			ะ	F1/5EC	76.87	36.56	76.44	76.27	76.16	76.13	16.14	76.10	76.CB
.50 INCHES 2.50 6.902 INCHES 28.63 INCHES	SECCNOARY AREA	SCUARE INCHES	0.0	12.566	25.133	50.265	100,531	150.75	201.062	248.186	****	5	F1/SEC	74.26	£5.68	53.63	102.75	166.52	110.00	109.06	108.16	* * * *
	PA-FNZ	~	2.34	2.23	1.59	93.0	0. 31	0.15	0.08	c. c5	0.0	UF	F1/SEC	185.75	164.55	184.70	184.31	184.03	183.55	183.58	163.88	183.83
LPTAKE CIAMETER: 11.50 INCHES AREA RATIC, AY/AF: 2.5C ORIFICE GIAMETER: 6.902 INCH ORIFICE BETA: 0.497 APBIENT PFESSUKE: 28.E3 INCH	PA-PS	INCHES OF WATER	3.34	2.24	1.59	0.86	C. 31	0.15	30.0	30.0	0.0	S)	L BM / SEC	J.)	6.624	1.054	1.550	1.662	1.542	1.851	1.646	* * * * * *
A 0 0 4	₽U-PA	INCE	2.80	3.75	04.4	2.00	5.50	5.60	5.70	5.70	5.80	ů.	L BM / S EC	3.672	3.668	3.671	3.671	3.472	3.673	3.673	3.674	3.673.
	TARE	FEIT	76.6	16.0	76.6	76.0	76.0	76.0	76.0	76.0	76.0	55° 4*L#H)·0	0.1653	0.2750	0.4164	0.4528	0.5141	9.5005	0.4865	***
ES .	TUPT	DEGREES FAFRENFEIT	112.6	112.5	112.1	111.5	111.8	111.6	1111.7	111.3	111.4	P*/T*		0.4851	0.3279	0.2326	0.1237	0.0451	0.0222	0.0118	0.0074	0.0
Y ACZZLES: 4 JAMETER: 3.70 INCHES GTF: 25.25 INCHES PETER: 11.70 INCHES : 2.50	1CR	OEGR	56.3	55.4	56.6	56.5	58.4	56.1	57.9	57.7	58.0	*		0965.3	C. 5362	6985.0	0.5372	0.5374	77.52.0.	0.5375	0.5342	0.5360
IMARY ACZZLES: 4 E OJAMETER: 3.70 INCH LENGTH: 25.25 INCHES EJAMETER: 11.70 INCHES L/O: 2.50	OPCR	. hATER	0.55	22°C	22.0	22.0	22.0	22.0	22.0	22 · C	22.0	ā		3.4541	0.3(70	0.2179	0.1168	0.6422	0.050.0	0.0111	693)*0	0.0
CF PR] NOZZL STACK STACK STACK	POR	INCHES OF	1.0	1.0	0.7	7.0	1.0	6.0	C-3	7.0	0.7	*		0.0	C.1702	C.2871	(.4223	C.5070	0.5265	(.5145	C.5C24	****
NLPEER PRIMARY PIXING PIXING	z	5		2	m	7	5	9	7	89	6	z	۱. A	1	2	01	4	••	9	7	83	5

PERFORMANCE DATA FOR STRAIGHT MIXING STACKS WITH PRIMARY NOZZLE DIAMETERS OF 3.70 IN. > TABLE

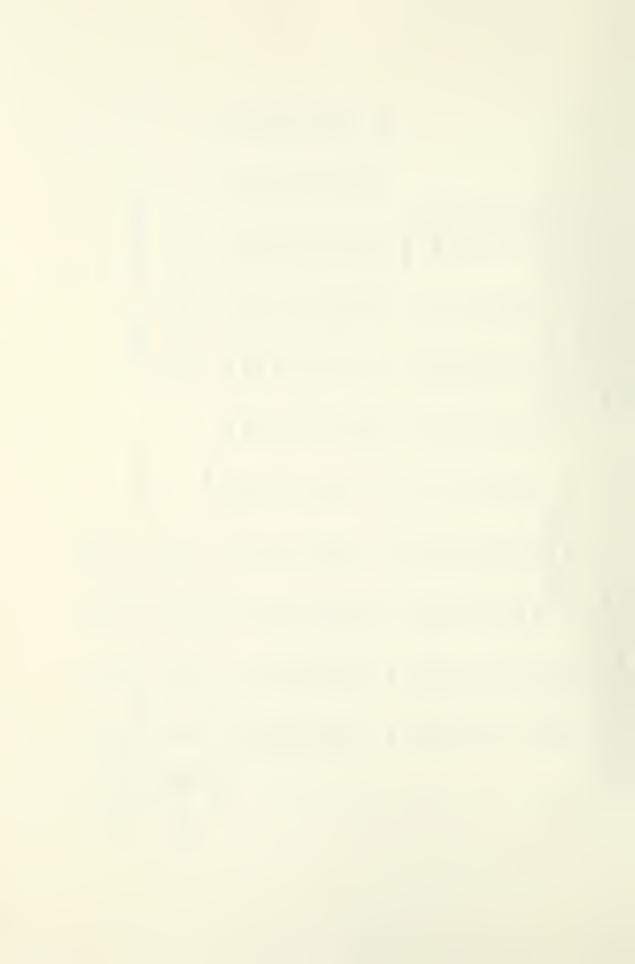
(a) L/D = 2.5, Run 1



	NUP EER	NUPEER OF PRIMAF	FY NO 22LES: 4	7 7 7	ğ			UPTAKE CLAMETEF: 11.50 INCHES	ETEF: 11	.50 INCHES		
	MIXING	-	LIMFELEN. 30TO IN	TACHER	3		•	ANEM RAILE, AFFAF		00.7		
_	MIVING	STACK 0 JA	AMETER: 11.70 INCHES	.70 INCHES				URIFICE DIAMESEN: ORIFICE BETA: 0.497	A: 0.497	0.902 INCHE	n	
	PIXING	PIXING STACK L/C:	: 2.5¢					AM EIENT PRESSURE:	SSURE:	29.58 INCHES HG	S HG	
Z		PCR	0 F C F	TCR	TUPT	TAME	P U-P A	PA-PS	PA-FAZ	SECENDARY AREA	AREA	
RUA		INCHES GF	HATER	DEGR	DEGREES FAMENHEIT	NHEIT	INC	INCHES OF WATER	u <u>r</u>	SCUARE INCHES	CHES	
-		٥.٦	22 · C	9.45	108.2	9.49	2.95	3.34	3.34	0.0		
2		7.0	22.0	9.45	108.2	9.49	3.80	2.31	2.31	12.566	66	•
m		1.0	22.0	55,3	168.6).49	4 .35	1.48	1.48	25.133	33	
4		7.0	22.0	55.3	108.7	0.49	2.00	6.5	0.58	56.265	65	
S		1.0	22.0	55.1	166.7	0.49	5.50	0.36	0.36	166.531	31	
9		6.3	22.0	55.1	106.8	9.49	5.70	61.0	0.18	150.756	26	
٠		7.0	22.0	55.3	108.8	9.49	5.70	0.12	0.12	201.062	29	
89		0.1	22.0	54.8	166.8	9.49	5.70	60.0	0.07	248.186	8 €	
6		0.7	22°C	55.5	106.7	9.49	5.80	0.0	0.0	*****	:	
z		* 3	ů.	*	F#/T#	55° + + 1+M	ď	3,	ځ	÷	3	LPT MACH
AU.							L8M/SEC	L8#/SEC	F1/SEC	FT/SEC	F1/SEC	
-		0.0	6144.3	O.5222	0.4857	0.0	3.756	J. 0	181.34	72.50	35.05	0.064
2		C.1743	0.3107	0.9222	0.2369	0.1662	3.758	C. 655	180.88	83.88	74.85	990.0
3		0.2753	C. 2C03	C.5215	0.2173	0.2694	2.756	1.049	186.51	89.06	14.10	0.064
4		0.4533	C.1282	0.5214	0.1391	0.4373	3.756	1.703	160.31	102.13	74.62	0.064
2		0.5508	684).0	0.5214	0.0531	0.5313	3.756	2.065	180.09	108.51	74.53	0.064
4		C.5761	0.0231	0.9212	0.0251	0.5556	3.756	2.164	180.03	110.16	14.50	0.064
۲		C-6362	0.0163	0.5212	0.0177	0.6136	3.756	2.389	175.58	114.11	74.48	0.064
ų.		(,5555	9600.0	0.5212	0.0103	0. 5762	3.757	2.253	180.04	1111.72	74.51	0.064
5	*	******	0°C	C.5214	0.0	***	3.755	****	175.66	****	74.43	0.064
1.	XING ST	JCK PRESS	PIXING STACK PRESSURE DISTRIBUTION FOR RUN:	18UTICN FC	R RUN:	9 PCS IT ICN	4					
	x/C:	0.0	05.5	1.00	1.50	2.00		1				
FMS(IN. HZC):	H2C):	1.450	(.535	0.605	0.335	0.130		(a)	ر ا	.c.z =	ruii 2	
	F # 5 # 2	C. 15E	(.127	0.082	9.0.0	0.018						
14	XIAG ST	ACK PRESS	PIXING STACK PRESSURE CISTRIBUTION FOR RUNS	IBUTICN FC		9 POSITICA	60	TABLE	LE V	(CONTINUED)	UED)	
	>7E:	0.0	0.50	1.00	1.50	2.00						
FMS(IN. FZCI:	1261:	1.750	C.81C	0.570	0.240	0.110						
	7 25 24	0.235	(.110	0.078	0.046	0.015						



														UPT MACH		0.064	9.064	0.064	0.064	490.0	990.0	0.064	990.0	730.0								
		9H	AREA	FES		9	æ	2	1	9	2	•	•	=	F1/5EC	75.25	75.05	75.04	74.53	74.61	74.76	14.78	14.76	74.74					UED)			
2.50 INCHES 2.50	.902 INCHES	29.85 INCHES HG	SECCNCARY AREA	SQUARE INCLES	0.0	12.566	25.133	50.265	100.521	15(.756	201.062	248.186	****	ż	FT/SEC	72.74	83.52	90.76	45*66	105.73	107.72	108.90	105.16	****			= 1.75		(CONTINUED)			
ETER: 11.	! .		FA-FAZ	œ	3.27	2.08	1.43	0.79	0.30	0.15	50.0	90.0) • <u>)</u>	ر. د	F1/5EC	181.52	181.25	161.32	181.05	180.77	186.65	186.70	180.64	18C.6C			Γ/D		LE V			
UPTAKE EIAMETER: 11.50 INCHES AREA RATIC, AP/AF: 2.50 ARIELOF DIAMETER: 4.902 INCH	URIFICE BETA: 0.457	AMEIENT PRESSURE:	PA-PS	INCPES OF WATER	5.27	2.05	1.50	51.0	0.30	C. 15	50.0	90.0	J•3	V)	LEF/SEC	J.J	619.3	1.627	1.526	1.681	1.555	2.041	2.077	****			(c)		TABLE			
5 4 6	9 0	4	PU-PA	INCF	2.90	3.50	4.50	5.10	5 .50	5.40	5.70	5.70	5.60	Q.	L8M/SEC	3.745	3:138	3.741	3.742	3.742	3.742	3.744	3.744	3.742	⋖				80			
			TAM8	HEIT	9.99	9.99	0.99	66.0	66.6	0.99	J.99	0.99	999	50044148		0.0	0.1558	0.2648	0.3535	0.4850	0.5145	0.5311	0.5354	******	PCS1110N				POS 11 ION			
ES .			TUPT	DEGREES FAHRENHEIT	165.7	110.5	110.9	110.9	110.7	110.6	116.5	110.4	110.6	*1/*d		0.4757	C.3064	0.2201	0.11.3	0.0443	0.0222	0.0133	0.0089	0.0	R RUN: 9	1.50	0.080	0.011	R RUN: 9	1.50	C.110	0.015
3.7C INCH	70 INCHES		TCR	DEGR	54.0	57.7	57.1	56.8	54.8	56.9	56.3	56.4	56.8	<u>*</u>		0.5232	0.5220	0.5213	0.5213	0.5216	ω.5218	0.5220	0.5221	0.5218	IELTION FO	1.00	0.370	0.050	BUT JCN FC	1.00	0.430	0.059
NOZZLES: IAMETEF:	PETER: 11.	: 1.75	DFCR	HATER	22.0	25.0	22.0	22.0	22.0	5.5.0	22.0	22.0	22.0	*		0.4392	5282.0	C.2C28	0.1071	60+0-0	C. (204	0.(123	0.0082	0.0	URE CISTA	C.50	(•55C	C.075	LRE CISTR	0.50	C • 100	(*(55
NUPEER OF FRIMAFY NOZZLES: 4 PFIMARY NOZZLE CIAMETEF: 3.7C INCPES PIXING STACK IENGTP: 20.48 INCPES	MIXING STACK OLAMETER: 11.70 INCHES	MIXING STACK L/O:	FCR	INCHES CF	7.0	1.0	7.0	1.0	1.0	1.0	7.0	۲٠)	C•3	*		J:)	C.1656	C.2745	6205.0	0.5027	C. 5333	0.5504	(.5548	*****	PIXING STACK PRESSURE CISTRIBLTION FOR RUN:	0.0	3.000	615.0	PIXING STACK FFESSURE CISTRIBUTION FOR RUN:	0.0	05E.I	C. 165
NUPEER PEINARY	PIXING	MIXING	۷	RUN	1	7	m	4	ĸ	ę	7	80	۰	۷	RUA	-	12	m	4	S	9	1	ຜ	** 5	PIXING ST	x/C:	FPS(IN. H2C):	F 5 4 3	PIXING ST	x/C:	PPSCIN. F2C11	10 to



20 2.766 20 2.766 30 7.76 11 3.767 11 3.767 11 3.767 11 3.767 11 3.767	99 0.2124 94 0.6074 54 0.6511 22 0.6864 48 C.6516 ******** 9 FCSINICN A 2.CC 0 0.610 5 0.083	.2564 0.5180 0.3862 0.1805 .2660 0.5176 0.2899 0.2124 .1538 0.5171 0.1677 0.4720 .636 0.9169 0.0694 0.6074 .0325 0.9166 0.0354 0.6511 .6203 0.5161 0.0148 C.6516 .637 0.5151 0.0 ******* E CISTRIELTION FOR RUN; 9 FCSTITCN A C.5C 1.60 1.50 0.016
	25 44 48 49 44 48 49 49 49 49 49 49 49 49 49 49 49 49 49	.3564 0.5180 0.3882 .2660 0.5176 0.2899 .1538 0.5171 0.1677 .636 0.9169 0.0694 .0325 0.9166 0.0354 .6203 0.5161 0.0222 .6137 6.5161 0.0148 .6 0.5151 0.0 E CISTALLINON FOR RUN: 1.56 I.620 1.200 6.110 0.219 0.162 0.015 E CISTALLINON FOR RUN: 0.162 0.150 I.450 0.760 1.50 1.450 0.740 1.50 1.450 0.740 0.460 C.202 C.1100 0.089

PERFORMANCE DATA FOR MIXING STACKS WITH A SEVEN DEGREE SOLID DIFFUSOR TABLE VI.



											UPT PACH		0.064	0.064	0.064	9.000	0.064	0.064	0.064	0.064	0.063								
H	AREA	., Ψ	44		41	_	.0				35	F1/5EC	75.45	75.16	75.08	75.02	74.83	14.18	14.11	74.62	74.75					(CONTINUED)			
1.50 INCFES 2.50 6.9D2 INCFES 7	SECCNCARY AREA	SQUARE INCHES	12.566	25.133	50.265	100.521	150.796	201.062	246.186	*****	ڎ	F 1/SEC	12.89	85.21	54.15	108.57	123.52	140.47	155.27	121.80	****		c						
UPTAKE CIAMETER: 11.50 INCLES AREA FATIC, AH/AF: 2.50 CRIFICE DIAMETEF: 6.9D2 INCH ORIFICE BETA: 0.457 AMBIENT PFESSURE: 30.14 INCH	FA-FN2	A 73	2.65	1.95	1.36	57.0	0.54	0.45	0.11	0.0	UF	F1/SEC	18 2 - 32	181.62	181.42	181.27	180.82	180.69	186.67	180.80	180.62		7	(D) Kull		TABLE VI			
UPTAKE CIAMETER: II AREA FATIC, AMAF: CRIFICE DIAMETEF: ORIFICE BETA: 0.457 AMBIENT PFESSURE:	FA-FS	INCHES OF MAJER	2.65	1.54	1.36	59.0	0.54	0.45	0.11	0.0	S #	L EM/SEC	0.0	069.0	1.184	1.977	2.806	3.137	4.549	2.712	****			<u>ت</u>		Ħ			
3 4 0 0 4	PU-PA	INCH 2.5.6	3,45	4.10	4.80	5.35	5.50	2.60	5.65	5.70	d.	LBM/SEC	3.740	3.739	3.142	3.743	3.746	3.736	2.736	2.737	3.735	<				60			
	TAPE	85.0	85°C	85.€	85.€	85.0	65.0	85 °C	85.0	8.5.C	74144.44		0.0	0.18C1	0.3067	0.5154	0.7321	0.5755	1.1877	9636.0	******	9 P051110N	2.00	0.620	0.067	9 PO \$1 TION	2.00	0.620	0.087
v:	TUPT	DEGREES FARKENFEII	116.0	116.0	116.1	116.0	116.5	116.5	117.3	117.2	P*/T*		0.5416	0.3874	0.2842	9561.0	0.1018	C. C798	9990.0	0.0155	0.0			0.975	0.136		1.50	1.070	0.150
CF PRIMAFY ACZZLES: 4 ADZZLE CIAMETER: 3.70 INCPES STACK LENGTH; 29.25 INCPES STACK DIAMETER: 11.70 INCHES STACK L/C: 2.50	TCR	UE68 62.3	9.29	61.9	61.5	62.2	62.5	63.4	63.2	63.8	*		6. 5453	C. 5461	(.5461	0.5460	0.9461	0.5453	0.5453	0.9440	0.5442	PIXING STACK FFESSLAE CISTRIBUTION FOR RUN:	1.00	1.225	0.171	E DISTRIBUTION FOR RUP:	1.00	C.780	0.109
CF PRIMARY ACZZLES: 4 ADOZZLE CIAMETER: 3.70 IN STACK LENGTH; 29.25 INCHES STACK DIAMETER: 11.70 INCH		22.0	22°C	22.0	22.0	22.C	25.C	22.0	22°C	22.0	*		0.5120	0.3665	5392.0	0.1888	0.0563	0.0755	6293°3	0.0147	0 •0	SLAE CISTR	0.50	1.560	C.218		0.50	1.500	C.210
		18CHES CF 0.2	0.1	7.0	0.1	0.1	1.0	1.0	1.0	٥.٦	*		0.0	C. 1845	0.3163	C.5281	2 05 1 0	1.0003	1.2174	C.725E	******	TACK FFES	٠ د	4.100	0.573	PIXING STACK PRESSU	0.0	2.600	0.364
ALPBER FRIPAFY MIXING PIXING	z .	, t	2	Э	4	5	9	7	œ	.	Z	RLA	1	2	3	4	2	ŗ	7	8	•	FIXING S	:0/4	FPS(IN. +2C):	FMS#S	P IX IAC S	*/C*	FPS (IN. F2C):	# 5 # 4 # 5 # 4



											UPT MACH		690.0	C.C64	6.064	0.063	690.0	0.064	0.063	690.0
9	AREA	뉴S		m	2	-	9	13	ę	•	1	F1/SEC	15.37	75.00	34.5E	14.67	74.54	75.03	74.83	75.62
.50 INCHES 2.50 6.502 INCHES	SECCNDARY AREA	SCUARE INCHES	0.0	25.133	50.265	100.531	156.756	201.062	248.186	***	ร้	FT/SEC	72.82	60.45	105.31	113.78	121.72	126.61	120.60	****
7 ~	PA-FAZ	83	₹• €	1.54	1.12	0.45	0.28	0.15	0.10	0.0	<u>.</u>	F1/5EC	182.13	181.22	161.18	186.51	181.09	181.25	180.82	181.27
LPTAKE CIAMETER: 11.50 INCHES AREA RATIC, AM/AP: 2.5C ORIFICE DIAMETER: 6.5C2 INCH CRIFICE BETA: 0.497 AP81ENT PFESSURE: 30.1E INCH	PA-PS	INCHES OF MATER	3.68	1.54	1.10	0.45	0.29	0.16	0.11	33.3	5 4	L B P / S E C	. .	1.176	1.767	2.253	2.681	2.616	2.637	****
	PU-FA	JVC	2.50	4.00	4.75	5.30	5.50	2.60	5.60	5.70	a.	L BM/SEC	3.725	3.726	3.735	3.728	3.733	3.725	3.725	3.727
	TAPE	HEIT	36.6	0.06	3.06	0.06	J.06	o.06	J•35)*)S	h+1++.44		0.0	6.3066	C. 4681	9355.0	0.7016	0.6835	0.6510	****
S	TUPT	DEGREES FAHRENHEIT	118.5	118.3	118.3	115.4	115.4	115.4	115.4	121.4	P* /T *		0.5365	0.2856	0.1620	9990.0	0.0421	0.0228	0.0156	C. C007
ACZZLES: 4 AMETER: 3.70 INCHES TF: 25.25 INCHES ETER: 11.70 INCHES 2.50	TCR	DEGR	66.1	66.5	64.6	64.5	65.0	65.5	66.1	6.99	*		0.5507	0.5510	0.5510	0.5492	0.5492	0.5492	0.5492	0.5460
RY ACZZLES: Clameter: 3 NGTH: 25.25 AMETER: 11.7	DPCR	F HATER	22.0	22°C	22.0	22.0	22.0	22.0	22°C	22 · C	*		C.5100	6.2716	C-1541	0.0632	0.0400	0.0217	0.0148	C.CC07
NLPEER CF PRIMARY PEIPERY NOZZLE GIE PIXING STACK LENGI PIXING STACK CIAPE MIXING STACK LIAPE	POR	INCHES GF	1.0	0.7	1.0	1.0	0.7	0.1	0.7	0.7	* 38		0.0	0.3155	53250)	0.6043	C.7180	(.6557	0.007.0	*****
PF11	z	RUR	7	2	м	4	u1	9	7	89	z	RLA		7	м	4	2	4	7	æ

(c) Run 3

TABLE VI (CONTINUED)



TAPE	TAPE	TAPLE PU-PA PA-PS FA-FA SQUARE INCHES	TAME	TAPE	⋖
TAPE PU-PA PA-PS FA-FN SECENCIFY AR FEENELIT TAPE PU-PA PA-PS FA-FN SECENCIFY AR FEENELIT TAPE PU-PA PA-PS FA-FN SECENCIFY AR FEENELIT TAPE TAP	ORIFICE DIAPETEF; 6.902 I ORIFICE BETA: 0.497 AMEIENT PRESSURE: 30.18 I T TAPE PU-PA PA-PS FA-FN SECCH SC.C 2.55 3.71 3.76 90.0 4.80 1.17 1.17 90.0 6.45 1.54 1.94 90.0 5.5 00.27 0.26 11 90.0 5.5 00.27 0.26 11 ONTERINATION A PA-PS FA-FN SECCH AMEIENT PRESSURE: 30.18 I AMEIENT PRESCRITION A AMEIENT PRESSURE: 30.18 I AMEIENT PRESCRITION A AMEIENT PRESCRITION B TARRITE VATE AMEIENT PRESCRITION B TARRITE VATE AMEIENT PRESCRITE AMEIENT PRESCRI	ORIFICE DIAPETEF; 6.902 I ORIFICE BETA: 0.497 AMEIENT PRESSURE: 30.18 I TAPE PU-PA PA-PS FA-FN SECCN SC.C 2.55 3.71 3.76 9 90.0 4.80 1.17 1.17 9 90.0 5.2C 0.16 0.16 2 9 90.0 5.2C 0.16 0.16 2 4 90.0 5.5C 0.16 0.10 2 4 90.0 5.5C 0.16 0.16 2 4 90.0 5.5C 0.11 0.10 12 4 90.0 3.723 0.0 182.57 72 9 0.6064 3.722 1.627 181.24 106. 9 0.6064 3.726 2.315 181.26 115. 9 0.6567 3.726 2.659 181.19 121. 9 0.6567 3.726 2.659 181.19 121. 5 0.6567 3.726 2.659 181.19 121. 8 POSITION A 2 CC 8 POSITION A 9 0.668	ORIFICE DIAPETEF; 6.902 I ORIFICE BETA: 0.497 AMEIENT PRESSURE: 30.18 I TAPE PU-PA PA-PS FA-FN SECCN S.C.C. 2.55 3.71 3.76 90.00 4.80 1.17 1.17 90.00 5.2C 0.46 0.47 1 90.00 5.2C 0.16 0.16 2 4 90.00 5.5C 0.16 0.16 2 4 90.00 5.5C 0.16 0.10 2 4 90.00 5.5C 0.16 0.16 2 4 90.00 5.5C 0.16 0.10 2 4 90.00 5.5C 0.11 0.10 1 2 0.5C 0.5C 0.11 0.10 1 2 0.5C 0.5C 0.10 1 2 0.5C 0.5C 0.10 1 2 0.5C 0.5C 0.10 1 3 7 7 0.5C 0.10 1 2 0.5C 0.5C 0.10 1 2 0.5C 0.5C 0.10 1 2 0.5C 0.5C 0.10 1 8 POSITION A 2 0.00 64 8 POSITION B TARBLE VI 2 0.5C 0.5C 0.5C 0.5C 0.5C 0.5C 0.5C 0.5C	TAPE	PRIMARY NOZZLE CIAMETER: 3.7C INCHES
HEIENT PRESSURE: 30.18 INCHES FG Take Pu-pa Pa-ps Fa-fn2 SECCNLEFY AREA HENHEIT INCHES CF MATER SQUAR FINCHES SGC. 2.55 3.71 3.70 0.0 90.00 4.80 1.17 1.17 50.265 90.00 5.20 0.40 0.47 100.531 90.00 5.50 0.27 0.26 150.766 90.00 5.50 0.27 0.26 150.766 90.00 5.50 0.27 0.26 150.766 90.00 5.50 0.27 0.26 150.766 90.00 5.50 0.27 0.26 150.766 90.00 5.50 0.27 0.26 150.766 90.00 5.50 0.27 0.26 150.766 90.00 5.50 0.27 0.26 150.766 90.00 6.40 MF MS UP UM LL LBM/SEC LEF/SEC FT/SEC FT/SEC FT/SEC 10.00 0.00 3.723 0.0 182.57 12.55 90.00 6.60 3.722 1.627 181.76 181.27 190.89 90.00 6.60 3.722 1.627 181.11 120.92 74.55 90.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 3.722 1.627 181.11 120.92 74.55 80.00 6.60 5.60 6.60 6.60 6.60 6.60 6.60	######################################	TAPE Pu-PA Pa-PE FA-FA SECCRETKY AREA FAENHEII FAENH	HEIENT PRESSURE: 30.18 INCHES FC 1 TAPE PU-PA PA-PS FA-FA SQUARE INCHES 2 5.55 3.71 3.76 0.0 2 90.00 2 90.00 3.72 3 0.615 4 HATTH-44 4 HATTH-44 5 HATTH-44 5 HATTH-44 5 HATTH-44 5 HATTH-44 6 HATTH-	TAME	PIXING STACK LENGTF; 29.25 INCFES PIXING STACK DIAPETER: 11.70 INCHES
TAPE	HENNEIT INCRES CF MATER SQUAR EINCHES 3 5C.C 2.55 3.71 3.1C 0.0 2 9C.O 4.05 1.54 1.94 25.133 9 9C.O 4.05 1.54 1.94 25.133 9 9C.O 4.05 1.17 1.17 50.265 9 9C.O 5.5C 0.46 0.47 100.531 9 9C.O 5.5C 0.27 0.26 15C.756 9 9C.O 5.5C 0.16 0.16 201.062 7 9C.O 5.5C 0.11 0.10 246.186 4 9C.O 5.5C 0.11 0.10 246.186 4 9C.O 5.5C 0.11 0.10 246.186 4 9C.O 5.5C 0.11 0.10 187.57 12.55 15.25 5 0.0 3.723 0.0 187.57 12.55 15.25 5 0.0 3.723 1.176 181.76 94.21 75.25 5 0.0 3.723 1.176 181.76 94.21 75.05 5 0.0 6.064 2.726 2.315 181.27 106.07 75.01 8 POSTITION A 2.CC 8 POSTITION B TARRIER INCRES 6 1.094 25.133 9 0.006 1.074 1.094 25.133 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.077 100.6531 1.076 0.006 1.077 100.6531 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.076 0.006 1.077 100.6531 1.077 10	TAPE	TAPE	TAPE PA-PS FA-FA SECCNLERY AREA 1 9C.C 2.55 3.71 3.7C 0.0 2 9C.O 4.05 1.54 1.94 25.133 9 9C.O 4.05 1.17 1.17 1.17 0.0 9 9C.O 4.00 1.17 1.17 1.17 1.00.531 9 9C.O 5.2C 0.27 0.26 15C.756 9 9C.O 5.5C 0.11 0.16 24c.166 1 9C.O 5.5C 0.11 0.10 24c.166 1 9C.O 5.5C 0.11 0.10 24c.166 1 9C.O 5.5C 0.11 0.10 24c.166 1 9C.O 5.7C 0.01 24c.166 11.15c 1 M*T***********************************	MIXING STACK L/D: 2.50
PRENHEIT INCHES CF HATE SQUAR F INCHES 3 5C.C 2.55 3.71 3.7C 0.0 2 9C.O 4.05 1.54 1.94 25.133 9 9C.O 4.80 1.17 1.17 50.265 9 9C.O 5.2C 0.46 0.47 100.531 6 9C.C 5.5C 0.27 0.26 15C.756 9 9C.C 5.5C 0.11 0.10 246.186 4 9C.C 6.0C 0.0 448.4844444 LL AMTINION MF MS 0.0 182.57 17.56 17.56 5 6.0C 2.726 2.515 181.27 14.56 17.56 5 6.5C 2.315	HENHEIT INCHES CF HATEF SQUAR F INCHES 3 51.1 3.1C 0.0 2 9C.C 2.55 3.71 3.1C 0.0 2 9C.C 4.C5 1.54 1.94 25.133 8 9O.O 4.69 1.17 1.17 50.265 9 9O.C 5.5C 0.46 0.47 100.531 9 9O.O 5.5C 0.16 0.16 201.062 7 9O.O 5.5C 0.11 0.10 246.186 4 9O.O 5.7C 0.01 0.10 246.186 4 9O.O 5.7C 0.0C 0.11 0.10 246.186 5 10 0.0C 0.11 0.10 246.186 5 10 0.0C 0.11 0.10 246.186 6 9C.C 5.5C 0.11 0.10 246.186 7 9O.O 5.7C 0.15 0.11 0.10 246.186 6 9C.C 5.5C 0.11 0.10 10.10 246.186 7 9O.O 3.723 0.0 182.57 12.55 75.55 7 0.0C 6.C 2.C 1.C 1.C 1.C 1.C 1.C 1.C 1.C 1.C 1.C 1	HENHEIT INCHES CF HATE 3 51.1 3.1C 0.0 2 9C.C 2.55 3.71 3.1C 0.0 2 9C.C 4.C5 1.54 1.94 25.133 8 9O.O 4.60 1.17 1.17 50.265 9 9C.C 5.50 0.27 0.26 15C.756 1 9C.C 6.16 0.11 0.10 24e.186 2 9C.C 6.16 0.11 0.10 24e.186 2 9C.C 7 0.11 0.10 1.10 1.10 1.10 1.10 1.10 1.	Since Sinc	Single S	FCR DFCF TCR
3 9C.C 2.55 3.71 3.7C 0.0 2 9C.O 4.05 1.94 25.133 9 9O.O 4.80 1.17 1.17 50.265 9 9O.O 6.80 1.17 1.17 50.265 9 9C.C 5.50 0.27 0.26 15C.756 9 9C.C 5.5C 0.11 0.10 246.186 4 9C.O 5.5C 0.11 0.10 246.186 5 6 0.11 0.10 246.186 11.56 4 9C.O 5.5C 0.11 0.10 4************************************	3 9CCC 2.55 3.71 3.7C 0.0 2 9CCO 4.05 1.54 1.94 25.133 9 0.0 4.80 1.17 1.17 50.265 9 9CC 5.2C 0.46 0.47 100.531 9 9CC 5.5C 0.27 0.26 15C.756 9 9CC 5.5C 0.11 0.10 24E.186 4 9CO 5.5C 0.11 0.10 24E.186 4 9CO 5.7C 0.11 0.10 24E.186 4 9CO 5.7C 0.11 0.10 24E.186 4 9CO 5.7C 0.0 4************************************	3 9CCC 2.55 3.71 3.7C 0.0 2 9CCO 4.05 1.54 1.94 25.133 9 9CCO 4.06 1.17 1.17 50.265 9 9CC 5.2C 0.46 0.47 100.531 9 9CC 5.2C 0.16 20.1062 1 9CC 5.5C 0.11 0.10 246.166 1 9CC 6.11 0.10 246.166 150.756 2 9CC 0.11 0.10 246.166 150.756 3 9CC 0.11 0.10 246.166 170.62 4 9CC 0.11 0.10 186.27 170.62 4 9CC 0.11 0.10 186.27 170.62 4 9CC 0.11 0.10 186.27 170.62 4 9CC 187.27 181.27 110.67 170.62 5 0.0664 3.727 1.627	3 9CCC 2.55 3.71 3.7C 0.0 2 9CCO 4.05 1.54 1.94 25.133 9 9CO 4.80 1.17 1.17 50.265 9 9CC 5.2C 0.46 0.47 100.531 9 9CC 5.2C 0.16 20.1062 9 9CC 5.5C 0.11 0.10 246.166 4 9CC 6.11 0.10 246.166 246.166 5 6 0.11 0.10 246.166 75.27 6 9CC 0.11 0.10 246.166 75.27 7 9CC 0.11 0.10 11.75	3 9CCC 2.55 3.71 3.7C 0.0 2 9CCO 4.05 11.54 1.94 25.133 9 9CCO 4.08 1.17 1.17 50.265 9 9CC 5.2C 0.46 0.47 100.531 9 9CC 5.2C 0.46 0.47 100.531 9 9CC 5.2C 0.11 0.16 246.166 4 9CC 5.5C 0.11 0.10 246.166 4 9CC 5.10 C.0C 0.0 4************************************	INCHES OF WATER DEGRE
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HATTH 4.44 WF HS UP UH LL LBM/SEC LEP/SEC FT/SEC FT/SEC FT/SEC H3 0.0 3.723 0.0 182.57 72.55 72.55 43 0.2079 3.723 1.176 181.74 106.C7 75.22 23 0.47E5 3.722 1.827 181.34 106.C7 75.C1 79 0.6064 2.72E 2.315 181.36 115.11 75.C6 99 0.67E5 2.72E 2.315 181.36 115.11 75.C6 90 0.65E 2.72E 2.659 181.19 120.95 74.55 90 0.65E 3.727 2.659 181.11 120.95 74.55 90 0.615 90 0.615 90 0.615	##T**.44 WF HS UP UH LL LBH/SEC LEP/SEC FT/SEC FT/SEC FT/SEC B3 0.0 3.723 0.0 182.57 72.55 72.55 B3 0.2079 3.723 1.176 181.76 94.21 75.22 B3 0.47E5 3.722 1.627 181.76 106.07 75.01 P3 0.6064 2.72E 2.315 181.36 115.11 75.06 P4 0.6064 2.72E 2.583 181.22 115.96 75.00 P5 0.6568 3.727 2.659 181.19 120.92 74.5E P 0.6568 3.727 2.659 181.11 120.92 74.5E B P051710N A 2.00 D 0.615 PARRIE VI (CONTINIED) RABRIE VI (CONTINIED)	##T**.44 WF HS UP UH LL LBH/SEC LEP/SEC FT/SEC FT/SEC FT/SEC B3 0.0 3.723 0.0 182.57 72.55 75.55 43 0.2079 3.723 1.176 181.74 104.C7 75.21 23 0.47E5 3.722 1.627 181.34 105.C1 75.C1 24 0.6064 2.72E 2.315 181.36 115.11 75.C6 25 0.6565 2.72E 2.583 181.27 15.11 75.C6 26 0.6567 2.72E 2.659 181.19 121.26 75.C0 27 0.6568 3.727 2.657 181.11 120.92 74.55 28 0.6568 3.727 ******** 181.27 ******* 75.02 29 0.6569 20 0	##T**.44 WF HS UP UH LL LBH/SEC LEP/SEC FT/SEC FT/SEC FT/SEC B3 0.0 3.723 0.0 182.57 72.55 75.55 B3 0.0 3.723 0.0 182.57 72.55 75.55 B3 0.47E5 3.723 1.176 181.74 104.C7 75.C1 B4 0.6064 2.72E 2.315 181.36 115.11 75.C6 B5 0.6565 3.72E 2.315 181.36 115.11 75.C6 B5 0.6567 3.72E 2.659 181.19 120.92 74.55 B6 0.6568 3.727 2.657 181.11 120.92 74.55 B7 0.6568 3.727 2.657 181.11 120.92 74.55 B8 0.65110N A TABLE VI (CONTINUED) B 0.65110N B TABLE VI (CONTINUED) B 0.6515	44.1**.44 WF HS UP UH LL 83 0.0 3.723 0.0 182.57 72.55 75.55 43 0.2079 3.723 0.176 181.76 94.21 75.22 23 0.47E5 3.722 1.176 181.74 106.C7 75.22 29 0.6064 2.72E 2.31S 181.26 15.11 75.01 29 0.6567 2.72E 2.659 181.19 121.26 74.5E 55 C.65C8 3.727 ********** 181.27 ******* 75.02 8 POSTITION A ******** 181.27 ******* 75.02 9 0.615 A A A 75.02 9 0.0064 A A A A 10 0.6547 3.727 ******** 181.27 ******* 75.02 10 0.615 A A A A A <	0.7 22.0 64.9 1
LBH/SEC LEP/SEC FT/SEC FT/SEC FT/SEC FT/SEC F1/SEC	B3 0.0 3.723 0.0 182.57 72.55 72.55 B3 0.0 3.723 0.0 182.57 72.55 75.55 B3 0.2079 3.723 1.176 181.74 94.21 75.22 B3 0.47E5 3.722 1.627 181.24 104.07 75.01 B4 0.6064 2.726 2.315 181.36 115.11 75.06 B5 0.6567 2.726 2.659 181.19 120.92 75.00 B 0.6568 3.727 2.627 161.11 120.92 74.55 B 0.61110N A B 0.615 CA) Run 4 CONTTNUED) B PC\$1110N B TARRER VI (CONTTNUED)	B3 0.0 3.723 0.0 182.57 72.55 72.55 B3 0.0 3.723 0.0 182.57 72.55 75.55 B3 0.2079 3.723 0.0 181.76 94.21 75.25 B3 0.47E5 3.722 1.627 181.36 175.21 B3 0.5064 2.726 2.315 181.36 115.11 75.02 B4 0.6567 2.726 2.583 181.27 115.26 75.00 B5 0.6567 2.726 2.659 181.19 120.92 74.55 B7 0.6567 3.727 2.659 181.19 120.92 74.55 B7 0.6568 3.727 2.627 181.11 120.92 74.55 B8 POSTITION A A A A A A A A A A A A A A A A A A A	LBH/SEC LEP/SEC FT/SEC FT/SEC FT/SEC LBH/SEC LEP/SEC FT/SEC FT/SEC FT/SEC LBH/SEC LEP/SEC FT/SEC FT/SEC FT/SEC LBH/SEC LBH/SEC LBH/SEC TS.SS TS.SS LBH/SEC LBH/SEC LBH/SEC LBH/SEC TS.SS TS.SS LBH/SEC LBH/SEC LBH/SEC LBH/SEC TS.SS	HANSEC LEP/SEC FT/SEC F	h+ P+ 1+ P
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99 0.6765 2.726 2.659 181.22 115.58 75.00 29 0.6567 2.659 181.19 121.26 74.58 55 C.6568 3.727 2.657 161.11 120.92 74.59 07 ******** 3.727 ******* 181.27 ****** 75.02 8 POSITION A 2.00 0 0.615 0 0.6066	99 0.6765 2.726 2.659 181.19 121.26 75.00 29 0.6547 2.726 2.659 181.19 121.26 74.58 55 C.6568 3.727 2.627 181.11 120.92 74.55 07 ************************************	99 0.6765 2.726 2.659 181.22 15.59 75.00 29 0.6547 2.726 2.659 181.19 121.26 74.56 55 C.6568 3.727 2.627 161.11 120.92 74.56 07 ********* 3.727 ******* 181.27 ****** 75.02 8 POSITION A 2.C0 0 0.615 9 0.0864 8 PCSITION B TABLE VI (CONTINUED) 2.C0	99 0.6765 2.726 2.659 181.26 15.56 75.00 29 0.6567 2.726 2.659 181.19 121.26 74.56 55 C.6568 3.727 2.627 161.11 120.92 74.55 07 ******** 3.727 ******* 181.27 ****** 75.02 8 POSITION A 2.C0 0 0.615 9 0.0064 8 PCSITION B TABLE VI (CONTINUED) 2.00 5 0.615	99 0.6765 2.726 2.683 181.25 115.58 75.00 29 0.6547 2.726 2.659 181.19 121.26 74.58 55 C.6568 3.727 2.627 161.11 120.92 76.55 07 ******** 3.727 ******* 181.27 ****** 75.02 8 PO\$!110N A 2.C0 0 0.615 9 0.086 1 TABLE VI (CONTINUED) 2.C0 5 0.608	C. £211 0.0642 0.5468 0.
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55 C.65C8 3.727 2.627 1E1.11 120.92 74.55 07 ************************************	55 C.65C8 3.727 2.627 161.11 120.92 74.55 07 ******** 3.727 ****** 181.27 ****** 75.02 8 POSITION A 2.C0 0 0.615 9 0.084 8 PCSITION B TABLE VI (CONTINIED)	55 C.65C8 3.727 2.627 161.11 120.92 74.55 07 ******** 3.727 ****** 181.27 ****** 75.02 8 POSITION A 2.00 0 0.615 9 0.086 8 PCSITION B TABLE VI (CONTINUED) 2.00	55 C.65C8 3.727 2.627 161.11 120.92 74.55 07 ******** 3.727 ****** 181.27 ****** 75.02 8 POSITION A 2.C0 0 0.615 9 0.086 8 PCSITION B TABLE VI (CONTINUED) 2.C0 5 0.615	55 C.65C8 3.727 2.627 161.11 120.92 74.55 07 ******** 3.727 ****** 181.27 ****** 75.02 8 POSITION A 2.C0 0 0.615 9 0.086 1 PCSITION B 1 TABLE VI (CONTINUED) 2.C0 5 0.615 6 0.6086	0.7137 0.C217 0.9466 0.0
07 ******* 3.727 ****** 181.27 ***** 75.02 8 POSITION A 2.C0 0 0.615 (d) Run 4	8 POSITION A 2.C0 0 0.615 9 POSITION B TABLE VI (CONTINUED)	8 POSITION A 2.00 0 0.615 9 POSITION B TABLE VI (CONTINUED) 2.00 2.00 8 POSITION B TABLE VI (CONTINUED)	8 POSITION A 2.C0 0 0.615 9 POSITION B 181.27 ****** 75.02 (d) Run 4 9 0.086 8 POSITION B TABLE VI (CONTINUED) 2.C0 5 0.615	8 POSITION A 2.00 0 0.615 9 PCSITION B TABLE VI (CONTINUED) 2.00 5 0.615 7 ******* 181.27 ****** 75.02	C.7075 C.(147 0.5471 0.
8 POSITION A 2.CO 0 0.615 (d) Run 9 0.084	2.C0 0.615 0 0.616 0 0.086 8 PC51110N B TARLE VI	8 POSITION A 2.00 0.615 9 0.086 8 PCSITION B TABLE VI 2.00	8 POSITION A 2.CO 0.615 9 0.066 8 PCSITION B TABLE VI 2.CO 5 0.615	8 POSITION A 2.C0 0.615 9 0.086 8 PCSITION B 7ABLE VI 2.C0 5 0.615	******* 0.CCC7 0.5460 0.0
2.00 0.615 (d) Run 0.08¢	2.00 0 0.615 9 0.0064 8 PC51110N B TARLE VI	2.00 0 0.615 9 0.086 8 PC\$1110N B TABLE VI 2.00	2.00 0.615 9 0.086 8 PC\$I110N B TABLE VI 2.00 5 0.615	2.00 0.0615 9 0.086 8 PC\$1110N B TABLE VI 2.00 5 0.615	PIXING STACK PRESSURE CISTRIBUTION FOR RUN:
0.615 (d) Run 0.08¢	0 0.615 (d) Run 4 9 0.066 8 PC51110N B TARLE VI	0 0.615 (d) Run 4 9 0.086 8 PCSI 110N B TABLE VI 2.00	0 0.615 (d) Run 4 9 0.08¢ 8 PC\$I110N B TABLE VI 2.00 5 0.615	0 0.615 (d) Run 4 9 0.064 8 PC\$!110N B TABLE VI 2.00 5 0.615	0.0 0.50 1.50 1.50
	9 0.08¢ 8 PC\$I110N B TARLE VI	9 0.08¢ 8 PC\$1110N B TABLE VI 2.00	9 0.08¢ 8 PC\$1110N B TABLE VI 2.00 5 0.615	9 0.08¢ 8 PC\$I1ION B TABLE VI 2.00 5 0.615	3.870 1.550 1.210 0.99
	B PCSITION B TABLE VI	8 PCSI110N B TABLE VI 2.00	8 PCSI110N B TABLE VI 2.00 5 0.615	8 PCSI11ON B TABLE VI 2.00 5 0.615	0.541 C.217 0.169 0.13



														LFT MACH		C.064	0.064	0.064	0.064	0.064	0.064	790.0	0.064		DIADHRACM		1				
			E G	ARE !	F.		ę	æ	wì	1	9	(V		3	FT/SEC	75.26	75.08	15.01	74.54	14.85	14.17	14.76	14.14		OPFN DI		mnnu i		_		
50 INCHES 2.50	6.902 INCHES		29.98 INCHES HG	SECCNDAFY AREA	SQUARE INCHES	0.0	12.566	25.133	50.265	100.521	150.796	201.062	***	à	FT/SEC	72.8C	E2.55	33.58	165.35	115.71	116.73	125.56	* * * * *		ROX	ה אם ה ה			(CONTINUED)		
E7ER: 11.	VETER: 6	155.0 : 4		FA-FNZ	~	(1) • (2)	1.67	1.87	1.13	54.0	(.25	0.15	0.0	Ļ	F1/SEC	162.05	181.43	181.25	181.07	180.87	180.66	186.66	180.59		TERTIARY	RIII.KHEAD					
UPT¢KE CIAME?ER: 11.50 INCHES Area raiio, am/ap: 2.50	CRIFICE DIAMETER:	ORIFICE BETA: 0.457	APBIENT PRESSURE:	FA-FS	INCHES OF WATER	3.34	1.66	1.87	1.13	55.0	92.0	0.19	0.01	SA	LEK/SEC	0.0	C.547	1.157	1.759	2.369	2.535	2.512	*****		(A) TE				TABLE VI		
	•	0		PU-FA	INCH	2.30	2.60	3.30	3.80	4.30	4.40	4.50	4.55	<u>م</u>	LEM/SEC	3.744	3.722	3.740	3.742	3.746	3.741	3.744	3.742	Ø				8	L		
				TAPE	IFEIT	84.0	84.0	84.0	84.6	84°C	94.0	84.0	84.C	PATA*.44		0.0	C.1432	9205.0	0.4655	9.6164	0.6632	0.7663	******	PCS1710N	2.00	0.550	0.083	NOILISON 8	2.00	0.660	£50°9
S)				11.07	CEGREES FARRENHEIT	112.8	116.4	112.5	113.0	112.7	113.1	112.8	113.1	F*/T*		0.4855	C.2446	0.2744	0.1662	0.0714	0.0377	0.0273	0.0015	R RUN: 8	1.50	1.010	0.142		1.50	1.100	C.154
4 3.7C INCP.	INCHES	70 INCHES		TCR	CEGR	56.6	64.6	59.8	55.1	56.1	55.4	58.7	59.2	<u>*</u>		0.5497	C.5438	0.5455	7675.0	6655.0	0.5492	1645.0	0.5452	E CISTRIBLTION FOR RUN:	1.00	1.310	0.184	E CISTRIBUTION FOR RUN:	1.00	****	* * * * * *
NCZZLES:	3TF; 29.25 INCHES	'ETER: 11.	1 2.50	OPCR	LATER	22.0	22.0	22.0	22.0	22.0	22.C	22.0	22.C	•		C.4611	0.2208	5072.0	0.1577	0.0679	0.0358	6523.0	0.0014	LRE CISTRI	05.0	1.540	C.216	LRE CISTRI	05.0	1.340	C.188
NIBER CF PRIMARY NCZZLES: 4 FFIDAFY NCZZLE (IAPETER: 3.7C INCFES	STACK LENGT	PIXING STACK DIFFETER: 11.70 INCHES	PIXING STACK L/DI	POR	INCHES OF	7.0	C.7	1.0	0.1	1.0	7.0	0.1	0.7	*		0.0	C.1469	£53E•3	6.4808	0.6326	C. £78£	C.7778	*****	PIXING STACK PRESSUR	o•c	3.550	0.498	PIXING STACK PRESSUR	0.0	2.430	0.341
N. MEER FPIPAFY	PIXING	• 1× 1v6	NIX ING					_				_	-		RUħ	_	64		J.	2	.	~	# #	VIXING ST	X/C:	FPS(1N. F2C):	FP 542	IXING ST	x 7/ C :	FPS(IN. F2C):	F + 2 + 5
				Z	R CP	1	14	æ	4	S	9		89	4	R	-	.•	1.1	•		•	,-	~	•		FPS(1)		•		FP5(I)	



PIXING STACK LENGTH: PIXING STACK DIAFETER MIXING STACK L/O: 2	K LENGTI		3./L 1NCHES	"			FRED FRIIC, AP/AP		7.50		
STAC STAC STAC	7										
STAC		63063 67	25.25 INCHES			_	ORIFICE OJAMETER:	APETEF: 6	6.5C2 INCHES	.	
STAC	K DIAPET	ref: 11.	: II.7C INCHES				CRIFICE RETA: C.497	TA: C.497			
6	K L/0:	2.50				•	AMEIENT PRESSURE:		30.07 INCHES P.C	. F.C.	
Ž		DFCR	1CR	TLPT	TAPE	PU-FA	PA-FS	FA-FA2	SECCNEARY AREA	AREA	
INCHES	Ç	MATER	CEGR	DEGREES FASRENFEIT	VFE IT	DNI	INCHES OF NATER	E.P.	SCLARE INCHES	:+Es	
0.7		22.0	4.09	114.1	96.C	2.10	3.62	3.62	0.0		
0.7		22.0	0.39	114.8	96.6	2.80	2.65	2.65	12.566	9	
0.7		22.0	1.09	115.0	96.0	3.30	2.03	2.03	25.133	C)	
0.7		22.C	60.1	114.8	86.0	3.85	1.21	1.21	50.265	8	
0.7		22.0	9.55	114.7	86.0	74.4C	0.46	65.0	100.531	11	
0.7		22.0	60.5	114.2	96.0	4 .50	0.25	0.25	156.756	į.	
0.7		0.55	66.1	114.1	86.0	4.60	6.16	0.16	201.062	2	
0.7		22.0	6.55	114.1	3.98	4 •60	0.11	0.10	246.186	9;	
C - 7		22°C	55.7	114.1	96.0	4.70	0.01	0.01	***	*	
*		* 0.	<u>*</u>	p * / T *	64 T * * . 4 4	N.	J.	5	ŝ	20	UPT PACH
						LBMISEC	L8Y/SEC	F1/5EC	FT/SEC	F1/5EC	
C •0	0	0.5004	0.5510	0.5261	0.0	3.143	0.0	16 2 . 0 5	12.78	75.34	0.064
C.1835		6996.0	6646.0	0.3862	0.1798	3.744	0.688	181.50	91.0	15.26	0.064
C.3219		0.2818	0.5495	C.2967	0.3147	472.2	1.205	181.67	54.73	75.18	790.0
C.4571		C.1687	0.5499	0.1776	0.4359	3.744	1.661	181.24	106.57	75.01	490.0
(.6323		0.0671	0.9500	0.0707	0.6182	3.746	2.368	180.98	115.77	74.50	990.0
0.6761		0.0351	0.5509	0.0369	0.6632	3.742	2.538	180.56	118.71	74.12	490.0
6.7230		C.C225	0.5510	0.0236	5.757.2	3.744	2.107	186.56	121.81	74.12	6.064
0.7054		0.(155	0.9510	0.0162	0.6566	3,745	2.641	186.57	120.61	74.73	0.064
*****		0.0014	0.5510	0.0015	****	3.745	****	180.56	****	74.72	0.064
STACK	FRESSLR	E CISTRI	PIXING STACK PRESSURE CISTRIBLTICN FCR RUN:		9 FCSITION	∢					
x/C: 0.0		0.50	1.00	1.50	2.00						
FMS(IN. +2C): 3	3.640	1.520	1.260	1.005	0.550		(f) TE AN	TERTIARY BOX AND BULKHEAD		CLOSED, D INSTALLED	CLOSED, DIAPHRAGM INSTALLED
3											
NE STACK PR	אלב אל	E DISTRI	MIXING STACK PRESSURE DISTRIBUTION FOR RUN:		S POSITION 3	8				,	
•	3.0	1,460	***	1,110	00.4		TABLE \	VI (CO	(CONTINUED)	_	
	766				,,,,,,						



				4			LL LFT PACH	F1/5EC	74.15 0.064		
50 INCHES 2.50	ORIFICE DIAPETER: 6.5C2 INCHES		AMEIENT PRESSURE: 30.07 INCHES HG	SECCNEARY AREA	SCUPPE INCPES	*****	5	FT/SEC F	****		
UFTAKE CIAMETER: 11.50 INCFES AREA RATIC, AM/AP: 2.50	APETER: 6	TA: C.457	ESSURE: 3	PA-FN2	E.F.	0.0	4	F1/5EC	175.27		
UFTAKE CIA	DRIFICE DI	CRIFICE BETA: C.457	AMEIENT PR	PU-PA PA-PS	. INCHES OF NATER	0.0	S	LBM/SEC LEP/SEC	****		
	_	•		PU-PA	JAC .	4.70 0.0	a.	LBM/SEC	3.775	4	
				TAPE	V-E1T	9.19	h*T**.44		***	1 PCSITION A	000
S H		s		TCR TUPT TAPE	DEGREES FAHRENFEIT	105.6	# L/ # d		0.0		
ALPEEF CF PRIMARY NCZZLES: 4 PRIPARY NCZZLE CIAMETER: 2.70 INCHES	25 INCHES	PIXING STACK CIAPETER: 11.70 INCHES		TCR	DEG	51.7	*		0.5317	CISTRIBUTION FOR RUN:	0.50
IRY NCZZLE	. NGTH: 29.2	APETERS 13	E: 2.5C	OFCF	IF NATER	22.0	ŧ		3.6	SIRE CIST	0.60
ALPEEF CF PRIMARY NCZZLES: 4 PRIPARY NCZZLE CIAMETER: 2.70	PIXING STACK LENGTH: 29.25 INCHES	STACK CI	PIXING STACK L/C:	FCR	INCHES OF MATER	0.7	*		*****	MIXING STACK PRESSIRE	J. J. 1/1
PRIPA	ŽI X I A	NIXIA	FIXIN(z	PLA		z	FLA		PIXING :	1/1

(g) PRESSURE DISTRIBUTION

TABLE VI (CONTINUED)

œ

1 PCSITION

MIXING STACK PRESSURE DISTRIBLTICN FOR RUN:

0.670

1.130

I-460

2.710

FPS(IN. F2C):

C.201

FFS#

2.00

I .50

1.00

0.50

: 3/x

C.64C 0.0EE

1.050

1.300

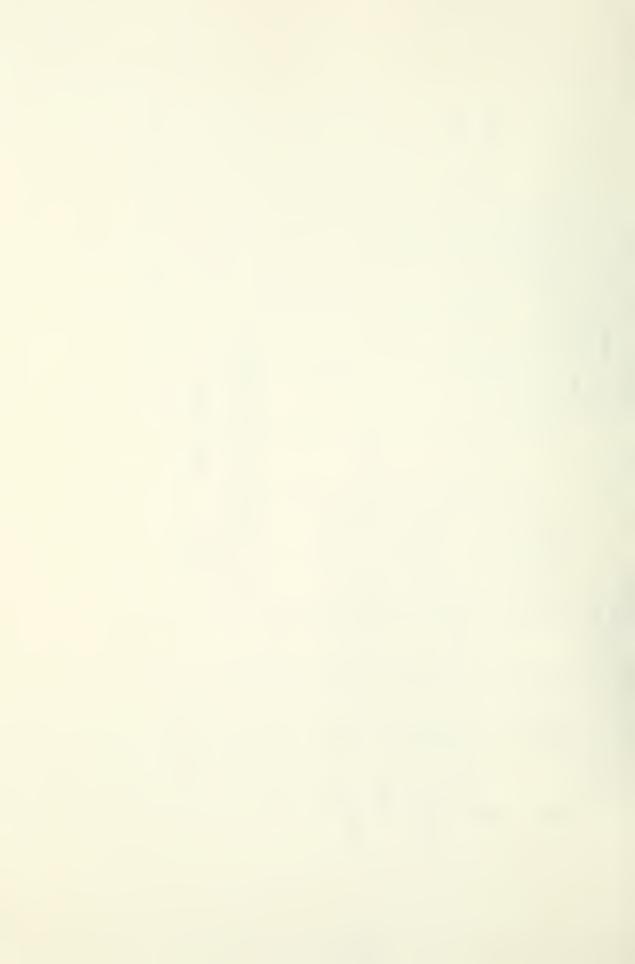
0.215

F + C # :

I.560

3.800

FPS(IN. PZC):



CATA TAKEN GN 11 MAY 1570 BY LEMKE AND STAEHLI S/C * .5: Z SCLID CIFFLSCR RINGS, SECGNOARY BCX OPEN

HEIT TAPE PU-FA PA-PS PA-PT SCCENOAFY ARE TERTIANY AREA PA-PS PA-PT SCCENOAFY AREA PA-PT SCCENOAFY AREA PA-PT SCCENOAFY AREA PA-PT SCCENOAFY AREA PA-PT PA-	NUMBER OF PRIMARY NGZ	ARY NGZ	ZZLES:	. 4	Ü			LFTAKE CLAMETER: 11.50 INCHES	HETER: 11.	50 INCHES		
CRIFICE BETA: 0.497 AMBIENT PRESSLRE: 30.13 INCFES HG	PHIPANY NCILLE LIAMENEN: 3.1L INCHES PIDING STACK LENGTH: 29.25 INCHES	LIAMEIEN: 3.16 INCHES ENGTP: 29.25 INCHES	3./L INCRES	ű				AREA KAIIU, CRIFICE DIA		2.50 E.SC2 INCHES		
## PU-FA PA-PS PA-PT SECCNOAFY AREA Inches F HATE SCUARE INches	MIXING STACK OIAMETER: 11.70 INCHES	IAMETER: 11.70 INCHES	. 70 INCHES					CRIFICE BE'	14: 0.497			
PB PU-FA PA-PS PA-PT SECTOOAFY ARE& 6.00 6.05 0.02 0.05 ************************************	PI) ING \$1ACK L/C: 2.50							AMBIENT PRE		10.13 IACFES H	9	
INCHES (F WATER SCUARE INCHES	FCR CFCR TCR TLPT	TCR		TLPT		TAFB	PU-FA	24-49	PA-PT	SECTNOAFY AF	•	RTIARY AREA
6.05 0.02 0.26 ************************************	INCHES DF hATER DEGREES FAHRENHEIT	FR	DEGREES FAHR	EES FAHR	w	NHEI 1	INC	HES CF WATE		SCUARE INCHE		LARE INCHES
6.05 0.C2 0.58 ************************************	0.7 22.0 56.2 109.9	56.2		109.9		16.0	6.65	0.02	0.10	*****		0.0
6.00	0.7 22.0 55.3 109.6	55.3		109.6		76.0	6.05	0.62	0.58	****		3.142
6.05 C.C2 O.24 ************************************	0.7 22.C 54.7 110.7	54.7		110.7		76.0	00.9	0.02	0.45	***		6.283
6.05 C.C2 O.24 ******** 1 6.10 O.C2 O.1E ******** 2 6.C5 C.C2 O.1C ******** 2 6.C5 C.C2 O.1C ******** 3 6.C5 C.C2 O.06 ******** 5 6.C5 C.C2 O.06 ******** 5 6.C5 C.C2 O.06 ******** 5 6.C5 C.C2 O.07 ******** 5 6.C5 C.C2 C.C2 C.C2 ******** 5 6.C5 C.C2 C.C2 C.C2 ********	22.	0 57.9		111.4		76.6	6.05	C.C2	0.31	***		12.566
6.10 0.02 0.10 **********************************	0.7 22.0 57.8 111.5	57.8		111.5		16.0	9.05	C.C2	0.24	****		18.850
6.05 C.C2 O.1C ************************************	0.7 22.¢ 57.2 111.0	57.2		111.0		76.6	6.10	0.02	0.16	****		25.133
6.05 0.02 0.08 ******* **************************	0.7 22.0 55.7 112.1	1.25		112.1		76.6	6.65	£3.3	0.16	****		37.699
6.05 C.CZ O.CC ********* ************************	. 2.2	56.9		112.0		74.6	6.05	0.02	90.0	****		50.265
LBM/SEC LEM/SEC FT/SEC FT/SEC FT/SEC 3.762 3.762 3.763 4***** 179.67 4***** 74.26 3.760 4***** 175.83 4***** 74.28 3.760 4***** 175.83 4***** 74.42 3.755 4***** 179.85 4***** 74.45 3.756 4****** 179.80 4***** 74.45 3.756 4****** 179.80 4***** 74.45 3.756 4****** 179.80 4****** 74.45 3.756 4****** 175.84 4***** 74.45 3.752 4****** 175.84 4****** 74.45 3.752 4****** 175.86 4****** 74.45 3.752 4****** 175.86 4****** 74.45 3.752 4****** 74.53	0.7 22.0 58.6 112.4	9.35 0		112.4		16.0	9.09	C.C2	0.00	****	*	***
WP hS UF LP UU LBM/SEC LEM/SEC FT/SEC FT/SEC FT/SEC 3.762 ******** 179.67 ****** 74.25 3.765 ******* 175.83 ****** 74.25 3.765 ******* 179.85 ****** 74.42 3.756 ******* 179.85 ****** 74.45 3.756 ******* 175.85 ****** 74.45 3.756 ******* 175.84 ****** 74.45 3.756 ******* 175.84 ******* 74.45 3.756 ******* 175.84 ******* 74.45 3.756 ******* 175.84 ******* 74.45 3.75 ******* 175.86 ******* 74.45 3.75 ******* 175.86 ******* 74.43 3.75 ******** 175.86 ******* 74.43 3.75 ******** 175.06 ******** 74.4	SECCACARY BOX											
LBM/SEC LEM/SEC FT/SEC FT/SEC FT/SEC 3.762 ******* 179.67 ****** 74.25 ******* 179.67 ******* 74.25 ******* 175.83 ****** 74.28 ****** 175.83 ****** 74.42 ****** 179.85 ****** 74.42 ****** 179.80 ****** 74.42 ****** 179.90 ******* 74.43 ****** 175.84 ****** 74.43 ****** 175.84 ****** 74.43 ****** 175.85 ****** 74.25 ******* 175.86 ******* 74.43 ****** 74.25 ******* 180.04 ******* 74.51 ******* 74.51	K* F* T* P*/T*	* 1* p*/T*	p*/T*		_	77. **I*N	d'	5.4	UF	ڔ	nn	UPT PACH
3.762 ****** 179.67 ***** 74.25 3.760 ****** 175.83 ****** 74.28 3.755 ****** 179.85 ****** 74.42 3.756 ****** 179.86 ****** 74.42 3.756 ****** 179.86 ****** 74.42 3.756 ****** 179.86 ****** 74.43 3.75 ****** 175.84 ****** 74.43 3.75 ******* 175.86 ****** 74.43 2.752 ******* 180.04 ****** 74.51							LBM/SEC	LEMISEC	FT/SEC	F 1/SEC	FT/SEC	
3.765 ****** 119.13 14**** 74.28 3.760 ****** 179.85 14**** 74.42 3.755 ****** 179.85 14**** 74.42 3.756 ****** 179.86 14**** 74.42 3.756 ****** 179.86 14**** 74.45 3.757 ****** 175.86 14**** 74.43 3.752 ******* 175.86 14**** 74.43 2.753 ******* 180.06 ****** 74.51	******* 0.C(26 C.5405 0.0028 *	C.5405 0.0028	0.0028		*	*****	3.762	***	13.61	****	74.35	430.0
3.760 ****** 175.83 ***** 74.42 3.755 ****** 179.85 ****** 74.43 3.756 ****** 179.90 ****** 74.43 3.756 ****** 175.84 ****** 74.43 3.752 ****** 175.86 ****** 74.43 2.752 ******* 180.04 ****** 74.51	******* 0.025 C.9410 0.0027 *	C.9410 0.0027	0.0027	-	*	******	3.765	****	175.73	*****	74.28	430.0
3.755 ****** 179.85 ***** 14.42 3.756 ****** 179.90 ****** 74.45 3.75 ****** 175.84 ***** 74.43 3.749 ****** 175.75 ****** 14.23 2.75 ****** 180.04 ****** 74.51	****** 0.6625 0.5392 0.0027 **	0.5392 0.0027	0.0027	-	*	******	3.760	****	175.83	***	74.42	430.0
3.756 ****** 179.90 ****** 74.45 3.756 ******* 175.84 ****** 74.43 3.749 ******* 175.75 ****** 74.25 2.752 ******* 180.04 ****** 74.51	******* 0.0025 0.5380 0.0027 **	0.5380 0.0027	0.0027		*	*****	3.755	****	179.85	***	14.43	0.064
3.749 ****** 175.84 ***** 74.43 3.749 ****** 175.75 ***** 74.25 2.752 ****** 175.66 ***** 74.51 2.753 ****** 180.04 *****	******* 0.0025 0.9378 0.0027 ***	125 0.9378 0.0027	0.0027		* *	****	3.756	*****	179.90	***	14.45	9.064
3.749 ****** 175.26 ***** 74.25 3.752 ****** 175.26 ***** 74.43 2.753 ****** 180.04 ****** 74.51	0.5367 0.0024	0.5367 0.0024	0.0024		*	****	3.758	****	175.84	***	14.43	790.0
3.752 ****** 175.66 ***** 74.43	0.5369 0.0024	0.5369 0.0024	0.0024		*	****	3.749	*****	175.75	****	14.25	0.063
2°52°3 ****** 180°04 ***** 74°51	0.5370 0.0022	0.5370 0.0022	0.0022		*	*****	3.752	*****	175.66	****	14.43	790-0
	******* 0.021 0.9364 0.0022 *	0.9364 0.0022	0.0022		=	*****	2.753	***	180.04	****	14.51	790.0

PERFORMANCE DATA FOR THE TWO-RING DIFFUSOR CONFIGURATION TABLE VII.



		u										
	UE	F 1/SE	****	***	***	***	****	****	***	***	****	•
	à	FT/SEC	***	****	****	****	****	****	****	****	***	λ.
	<u>,</u>	L EM / S EC	0.0	0.08	C. 14	0.24	0.31	C.36	0.40	(.47	***	
	K S	LBM/SEC	*****	*****	****	*****	*****	****	*****	*****	****	⋖
	MT+TT++.44 KM		0.0	0.021	0.037	290.0	0.080	E50*0	0.102	0.121	*****	POSITION
	PT*/TT*		0.1035	0.0856	0.0658	0.0459	1 - 60 • 0	0.0259	0.0141	0.0111	C.0007	RUN: 9
	¥.		C. 5405	C. 5410	0.5392	0.5360	6.5378	0.5387	0.5369	0.5370	0.5364	IBUT IGN FCR
	#14		0.0573	0.0806	0.618	0.6430	0.0326	0.0243	6.(132	0.0104	0.000	SLRE CISTRI
TERTIARY BCX	*LX		0.0	C.0216	0.0379	C.0633	C-0827	C.C551	6.1054	(.1248	***	G STACK FRESSLAE CISTRIBUTION FCA
TEAT	z	RLA	7	2	m	4	••	ę	7	8	6	MIX ING

PYD: 0.0 0.50 1.50

FPS(IN. P2C): 3.050 1.230 C.910 0.580

PH: 0.422 C.I70 0.126 0.080

PIXING STACK PRESSURE CISTRIBUTION FOR RUN: 9 FOSITION 8

PIXING STACK PRESSLRE CISTRIBUTION FOR RUN: 9 FOSI X/C: 0.C C.50 1.CO 1.50 FPS(IN. F2C): 1.910 I.160 ****** 0.580 FPS(IN. F2C): 0.264 C.161 ****** 0.080

TABLE VII (CONTINUED)



CATA TAKEN ON 14 JULY 1576 BY LEPKE AND STAEHLI S/C = .5: TPFEE SOLIO CIIPFUSOR RINGS , SECCNOARY BOX OPEN

					TERTIARY AREA	SCUARE INCHES	٥٠٥	3.142	6.283	12.566	18.850	25.133	37.655	50.265	* * *		UPT M &CH		0.064	990.0	0.064	3.064	0.064	0.064	0.064	0.064	990.0
				U	Ť			m	•	12	18	17	3.7	<u>0</u>	***		n nn	FT/SEC	74.86	74.83	74.86	74.81	14.78	14.71	74.85	75.01	74.86
50 INCHES	2.50	CRIFICE CIAMETER: 4.5C2 INCHES		29.97 INCFES HG	SECCNOARY AREA	SCUARE INCHES	****	****	****	*****	***	****	****	******	****		¥	F1/5EC	****	****	***	****	****	****	****	****	***
METER: 11.	. 44/45 :	AMETER: 4	TA: C.457		PA-PI	E	55.0	24.0	0.33	0.22	0.16	0.11	0.07	0.05	0.0		r.	F1/SEC	160.68	180.82	180.50	180.76	180.69	180.54	180.86	181.25	180.89
UPTAKE CLAMETER: 11.50 INCHES	AREA FATIC, AM/AF: 2.50	RIFICE CI	CRIFICE BETA: C.457	APRIENT PRESSURE:	PA-FS	INCHES OF MATER	0.01	23.3	0.01	0.01	0.01	0.01	10.0	0.01	10.0		S	Lew/SEC	*****	***	****	****	****	****	****	*****	****
_	•	J	J	•	PU-FA	INC	00.9	00.9	6.00	00.9	6.CC	00.9	03.9	6. CC	9.00		ŭ.	L BM/SEC	3.727	3.735	3.736	3.735	3.734	3.730	2.733	3.741	3.7.5
					TAFB	hEIT	85.0	85.€	85.0	85.0	95.0	85.0	95°C	8 F. C	85.0		h*T** 44		****	*****	*****	*****	******	*****	*****	******	*****
	ES				11.9.1	DEGREES FARRINEIT	114.5	114.5	114.6	114.4	114.4	114.4	115.1	115.0	114.2		p*/1*		0.0015	0.0030	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
4	TER: 3.70 INCHES	29.25 INCHES	.70 INCHES		TCR	066	66.3	1.09	6C.4	8°39	61.2	62.1	61.5	55.1	55.7		<u>*</u>		98 55 0	0.5486	£.5485	0.5488	0.5488	0.9488	92 45 0	0.5478	0.5491
RY ACZZLES:	CIAMETER:		AFETER: 11	D: 2.50	CFCR	CF NATER	22°C	22.C	22.0	22.0	22.0	22.0	22.0	22.0	22°C		d		0.0014	0.0028	0. CC14	0.0014	0.0014	0.0014	9.0014	4133.3	0.0014
NLPEER CF FRIMARY AC	PRIMARY NCZZLE CIAME	PINING STACK LENGTH:	MINING STACK OIAMETER: 11.70 INCHES	HIXING STACK L/D:	FCR	IACHES C	6.7	0.7	0.7	0.7	1.0	0.7	1.0	1.0	0.7	SECCNEARY BCX	*		*****	*****	*****	*****	******	*****	******	*****	*****
NLAB	PR 11.	1414	F 17.1	HIXI	~	RUP	-	2	m	4	2	9	7	8	5	SECCNE	4	RLA	1	7	ы	4	ď	ç	7	8	G *

PERFORMANCE DATA FOR THE THREE-RING DIFFUSOR CONFIGURATION TABLE VIII.



TABLE VIII (CONTINUED)

=	ERTIARY BOX	80×									
z		*	₽T*	*11	PT 4/TT#	MI*TI** 44 NN	44 NH	14	à	UE	
RCN							L BM/SEC	LBM/SEC	FT/SEC	FT/SEC	
1	_	0.:	0.0687	0.5486	0.0724	0.0	-		****	****	
2	J	:.6178	0.0554	0.5486	0.0584	0.017	****		****	***	
m	J	C.0222	0.(456	C.5485	0.0480	0.031	-	C-12	****	***	
4	J	:.0531	0.0309	0.5488	0.0326	250.0			*****	*****	
u1	•	5.6675	0.0225	0.5488	0.0237	990.0			****	****	
ę	J	8677.3	0.0158	0.5488	0.0166	9.00			****	****	
7	•		0.0091	0.5476	9600.0	0.085			****	****	
80	J	0.1010	0.000	0.5478	0.0074	553.0	****		* * * * *	****	
6	*	*****	0. 0	0.5491	0.0	*****	*****	****	****	****	
1	XING STA	ICK FFESS	LRE CISTR	18UT ION FC	R RUA:	9 POSITION A	4 Z				
	x / C:	:	X/E: C.C 0.25 0.50 C	0.50	6.75	1.00	1.50				
FPS(IA. FZC):	1024	1.940	1.430	1.180	1.050		0.720				
	FP 54:	272.0	C.200	0.165	0.147	0.115	0.101				

0.710

9 POSITION 8 1.C0 1.50 0.910 0.710 0.128 0.10C

MIXING STACK PRESSUFE DISTRIBUTION FOR RUN:

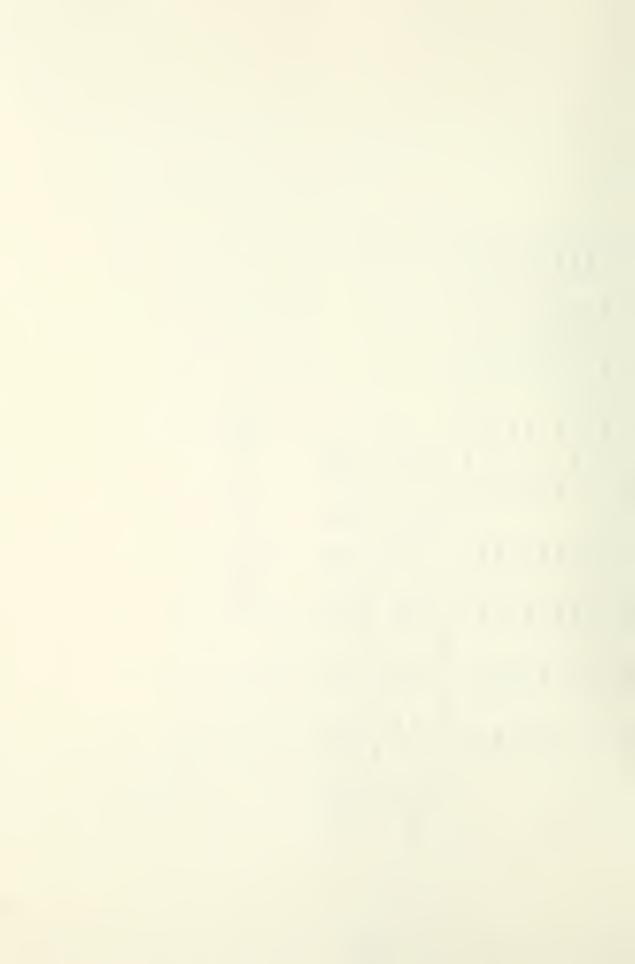
X/C: 0.0 0.25 0.50 0.75

IIN. P2C): 2.13C 1.37C 1.140 1.C2C

FPS*: 0.299 C.152 0.160 0.143

FPS(IN. F2C): FPS4:

0.100



												HOW TON		ò	*****	****	*****	7000	990.0	740	770	700.0									
ب ب س	•	# U U U	,	4	2 .:	• <u> </u>	· =	• •	. 19		•	3	F1/5EC	75 60	75.44	76. 36	76 37	75.23	75.64	75.63	75.11	75.25									
UPTAKE CIAMETER: 11.5C INCHES AREA RATIC, AF/AF: 2.5O CRIFICE CIAMETEF: 4.5O2 INCHES ORIFICE BETA: C.457 AMETENT PRESSURE: 25.87 INCHES HG	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	CCCACE INCER		12.544	75.133	50.245	100,531	156-756	201.062	246.166	****	à	F1,5EC	72.04	84.42	52.26	102.42	109, 54	110.54	113.11	116,24	****			4	· 0			c	, u	
FR: 11.	FA-5A2		10.01	2.27	1.62	C • 55	0.37	0.16	0.11	0.08	0.01	ت	F1/SEC	182.68	182.25	187.08	18 2 .00	181.79	181.33	181.25	181,51	181.94		,	0.00	0.010		,	0.070	5000))
UPTAKE CIAMETER: 11 AREA RATIC, AF/AF: CRIFICE CIAPETEF: ORIFICE BETA: C.457 AMEJENT PRESSURE:														-	Ŋ									35	****	***		1.75	****	* * * * *	
UPTAKE AREA R. CRIFICI ORIFICI	PA-F.	INCLES OF MATER	61	2.27	1.62	(.55	0.37	C.16	0.11	C.CE	C.C1	7	LEMISEC	3	0.645	1.050	1.670	2.084	2.150	2.212	2,352	*****		1.60	****	****		1.50	C.250	C.035	
	PU-FA		3.10	4.00	4.55	5.25	5.75	5.50	5.55	9.00	6.05	J.	L8M/SEC	3 21	3.720	3.715	3.725	3.726	2.720	3.717	3.716	3.724	⋖	1.25	41	-	au		່ ບ		
	TAPE	NFEIT)·57	9.59	9.59	2.59	9.59	2.59	0.59	9.59	9.59	h+T++.44		0.0	0.1670	0.2622	0.4315	0.5383	0.5545	0.5885	0.4153	*****	PC & 1110N A	1.00	, O		F051110N B	1.00	• •	0 *****	
1 2	TLPT	CEGREES FAHRENHEIT	115.5	116.4	116.8	116.6	116.2	116.3	116.7	117.6	117.8	*1/*d		0.4825	0.3326	0.2381	0.1397	0.0545	C.C259	0.0163	0.0111	0.0015	R RUN: 9	0.75	0.675	0.091	RUN: 9		0	0.000	
3.7c 1NCHES 10.70 1NCHES 10.70 1NCHES	TCR	CEG	62.8	63.3	63.5	61.9	6.39	63.2	0.49	64.3	62.0	*		£.5185	X. 5177	C. 5171	0.5174	.0.9180	0.5179	0.5172	0.9158	0.5155	RE CISTRIBUTION FOR RUN:	0.50	0.865	0.117	BUT JON FOR	0.50	0.780	0.105	rion
ALPBER CF FRIMARY ACZZLES: 4 FFIDARN ACZZLE CIAMETER: 3.7C INCHES MIXING STACK LENGTH: 29.25 INCHES MIXING STACK CIAMETER: 11.70 INCHES MIXING STACK L/C: 2.50	DFCA	FWATER	3.5.C	22.0	22.C	52.0	22.0	22.0	22°C	22.0	22.0	*		0.4432	0.3053	0.2163	0.1282	0.0500	0.0238	C.C150	0.0102	0.((13	LRE CISTRI	C-25	****	****	PIXING STACK FRESCURE CISTRIBUTION FOR RUN:	C-25	C. 92 5	0.125	FIGURATION
NLPEER CF FRIPAFF FFIPER NCZZLE C PIXING STACK LENO PIXING STACK CIAM	FCA	INCHES CF	C•3	1.0	0.1	0.7	6.7	0.7	۲٠٦	٥٠٧	0.7	*		0.0	0.1734	0.2931	C.4482	C. 5589	C.5778	C. (113	16491	***	MIXING STACK FRESSL	0.0	****	* * * *	ACK FRESSI	0.0	****	****	CLOSED CONF
ALPERA FINING PINING PINING	~	ALA	7	2	9	4	u 1	÷	~ `	، ب	5	٠ :	. א		7	m	4	u , ,	.	• 6		*	IXINE ST	: 1/ <	FPSLIN. F2C1:	FF 04:	IX INC ST	37C:	FPS(IN. FZC):	1 80,44	CLOS
		α										- 1	ox.	•		•••	•		- 1	- (- (•		FPSCIA		•		FFSCIA		(a)

PERFORMANCE DATA FOR THE PORTED MIXING STACK TABLE IX.



CATA TAKEN CN 7 ALG 1576 BY LEMKE AND STAEHLI S/C = .5; FCRTED PIXING ST.CK, A-1 CONFIGURATION, SECONDARY BOX OPEN

(b) A-1 CONFIGURATION

TABLE IX (CONTINUED)



N	TERTIARY BCX	. BCX									
C.0 0.C251 0.5302 0.0378 0.0 3.6£2 C.C ******* C.0102 0.C1E0 0.5221 0.C1S4 0.010 3.6£0 C.C ****** C.0162 0.C1E0 0.5221 0.C1S4 0.010 3.6£0 C.C£ ****** C.0242 0.CC22 0.S221 C.C067 C.CZ4 3.6£3 0.C5 ****** C.0242 0.CC22 0.S231 0.0030 0.CZ7 3.6£0 C.C£ ****** C.0242 0.CC24 0.S313 0.0030 0.CZ7 3.6£0 C.C ****** C.0242 0.CC24 0.S311 0.0022 0.CZ7 3.6£0 C.C ****** C.0242 0.CC24 0.S311 0.0022 0.CZ7 3.6£0 C.10 4**** C.0242 0.CC24 0.S311 0.0022 0.CZ7 3.6£0 0.C2 0.12 ****** C.0242 0.CC24 0.S311 0.0022 0.CZ7 3.6£0 0.CZ 0.12 ****** C.0242 0.CC24 0.CC14 0.S311 0.0022 0.CZ7 3.6£0 0.CZ 0.12 ****** C.0242 0.CC24 0.CC14 0.S311 0.0022 0.CZ7 3.6£0 0.CZ 0.12 ****** C.0242 0.CC24 0.CC26 0.CZ 0.CZ 0.CZ 0.12 0.CZ 0.CZ 0.12 0.CZ 0.CZ 0.CZ 0.CZ 0.CZ 0.CZ 0.CZ 0.CZ	4	*	F1*	* I	P1*/11*		44 44	7			J.
C.0 0.0351 0.6378 0.0 3.612 C.C ****************** C.0102 0.C160 0.5221 0.C154 0.010 3.62 0.04 ********* C.0162 0.C111 0.5319 0.0139 0.C16 3.663 0.C2 ******* C.0242 0.C122 0.5321 0.0030 0.024 3.663 0.C2 ******* C.0242 0.C122 0.5319 0.0030 0.024 3.661 0.05 ******* C.0242 0.C124 0.5319 0.0032 0.024 3.661 0.05 ******* C.0242 0.C214 0.5311 0.0015 0.027 3.664 0.13 ****** C.0242 0.C214 0.5311 0.015 0.027 0.027 0.027 0.027 0.027 0.027 0.037 0.047 0.007 0.007 0.007 0.007 0.007 0.007 0.007 0.007 0.007 0.007 0.007 0.007 0.007 0.007 </td <td>RUN</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>LBM/SFC</td> <td>Ler/se</td> <td></td> <td>SEC</td> <td>FT/SEC</td>	RUN						LBM/SFC	Ler/se		SEC	FT/SEC
C.0162 0.C1EG 0.6321 0.C1S4 0.016 3.676 0.04 ************************************		0.0	0.0351	0.5302	0.0378	0.0	3.682	J. J	*		72.63
C.0162 0.C111 0.5319 0.0119 0.C164 3.6E0 C.C6 ************************************	7	C.0103	0.010	0.5321	0.C154	0.010	3.676	0.04	•	*	73.11
C.0242 O.CC62 O.S321 C.064 C.024 3.6E3 O.C5 ************************************	r)	C.0162	0.C111	0.5319	0.0119	0.016	3.660	33.3	-	*	73.61
C.0245 C.CC2E D.6313 0.0030 0.024 3.6E1 0.05 ************************************	4	C.0242	0.0062	0.5321	C. CO67	6.624	3.663	50.0	-	*	74.26
G.C2EC O.CC21 0.5319 0.0022 0.027 3.65C C.10 4****** C.0242 0.CC14 0.5311 0.0015 0.027 3.65C C.12 ******* C.0 0.C C.5303 0.0 0.0 3.617 C. ******* 444**** 0.C C.5303 0.0 ******* 3.617 C. ******* 444**** 0.C C.5300 0.C ******* 3.617 C. ******* 1ACK PRESSLAR C.5300 0.75 1.00 1.25 1.50 1.75 2.00 1.72C C.680 0.750 0.670 ****** 0.052 C.C36 ****** 0.010 1.72C C.680 0.750 0.670 ****** 0.052 C.C36 ****** 0.010 0.236 0.093 0.103 0.092 ****** 0.052 C.C36 ****** 0.010 1.56C ******* 0.50 0.50 0.50 <td>41</td> <td>C+0543</td> <td>6.6628</td> <td>X. 5313</td> <td>0.0030</td> <td>0.024</td> <td>3.681</td> <td>50.0</td> <td>•</td> <td>*</td> <td>14.27</td>	41	C+0543	6.6628	X. 5313	0.0030	0.024	3.681	50.0	•	*	14.27
C.0242 0.CC14 0.5311 0.0015 0.022 3.65C 0.12 ****** C.0 0.C C.5303 0.0 0.0 3.677 0.C ****** C.0 0.C C.5303 0.0 0.C ******* 3.65C 0.12 ****** *****************************	9	0.0260	0.0021	0.5319	0.0022	0.027	3.684	01.0	•	*	74.55
Color Colo	7	C.0242	0.0014	0.5311	0.0015	0.033	3.650	0.13	-	*	75.19
14CK PRESELRE CISTRIBUTION FCR RUN: 9 PGSITION B 0.0 C.25 C.50 0.75 1.00 1.25 1.50 1.75 2.00 1.72C C.680 0.750 0.670 ****** 0.052 C.28C ****** 0.070 0.236 0.093 0.103 0.092 ****** 0.052 C.C38 ****** 0.010 TACK PRESSURE DISTRIBUTION FOR RUN: 9 PCSITION A 0.0 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 1.56C ****** 0.850 0.660 0.520 0.365 ***** ***** 0.080 C.214 ****** 0.117 0.091 0.071 0.050 ***** ****** 0.011	¥	0.0	٥• د	C.5303	0.0	0.0	3.677	0.0	* * * *	:	12.51
14CK PRESSLRE CISTRIBUTION FOR RLN: 9 POSITION B 0.0 C.25 C.50 0.750 1.00 1.25 1.50 1.75 2 1.72 C.680 0.750 0.670 ******* 0.380 C.28C ****** 0.236 0.093 0.103 0.092 ****** 0.052 C.C36 ****** TACK PRESSUFE DISTRIBUTION FOR RUN: 9 POSITION A 0.0 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2 1.56C ****** 0.850 0.660 0.520 0.365 ***** ****** C.214 ***** 0.117 0.091 0.071 0.050 ****** ******	5	****	0.0	0065.3	J.0	***	3.650	* * * * * *	***	:	72.78
0.0 C.25 C.50 0.75 1.00 1.25 1.50 1.75 2 1.72C C.680 0.750 0.670 ****** 0.380 C.28C ****** 0.236 0.093 0.103 0.092 ****** 0.052 C.C38 ****** TACK PRESSURE DISTRIBUTION FOR RUN: 9 PCSITION A 0.0 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2 1.56C ****** 0.850 0.660 0.520 0.365 ***** ***** C.214 ****** 0.117 0.091 0.071 0.050 ***** ******	PIXING ST	ACK PRESS	LRE CISTR	IBUTICN FC	R RLN: 9	DESTIC	6 0				
1.72C C.680 0.750 0.670 ***** 0.380 C.28C ****** 0.236 0.093 0.103 0.092 ***** 0.052 C.C38 ****** TACK PRESSURE 0ISTRIBUTION FOR RUN: 9 PCSITION A 0.0 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2 1.56C ****** 0.850 0.660 0.520 0.365 ***** ****** C.214 ****** 0.117 0.091 0.071 0.050 *****	: J/C		62.3	0.50	0.75				1.75	2.00	
0.236 0.093 0.103 0.092 ***** 0.052 C.C38 ****** TACK PRESSUFE DISTRIBUTION FOR RUN: 9 PCSITION A 0.0 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2 1.56C ****** 0.850 0.660 0.520 0.365 ***** ****** C.214 ****** 0.117 0.091 0.071 0.050 ****** ******	\$(IN. F2C):		C. 680	0.750	0.670	****	0.380		****	0.070	
TACK PRESSUFE DISTRIBUTION FOR RUN: 9 PCSITION A 0.0 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2 1.56C ****** 0.850 0.660 0.520 0.365 ***** ****** C.214 ****** 0.117 0.091 0.071 0.050 *****	FFS#S	0.236		0.103	0.092	****	0.052		*****	0.010	
0.0 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2 1.56	PIXING ST	ACK PRESSI	URE OISTR	IEUTION FO		PCSITIO	4				
1.56C ***** 0.850 0.660 0.520 0.365 ***** ****** ****** C.214 ****** 0.117 0.691 0.071 0.050 ******	x/E:	0.0	0.25	0.50	0.75				1.75	2.00	
C.214 ***** 0.117 0.C91 0.071 0.050 ***** *****	\$11N. F2C) 4	1.560	****	0.850	0.460	0.520	-		*****	0.080	
	F # 5 # 1	C.214	****	0.117	0.091	0.071			****	0.011	

TABLE IX (b) (CONTINUED)



[ATA TAKEN CN 7 AUG 1576 BY LEHKE ANG STAEFLI S/C = .5: FCRIEC FIXING STACK, A-1 B-1 CONFIGURATION, SECCNCARY BOX CPEN

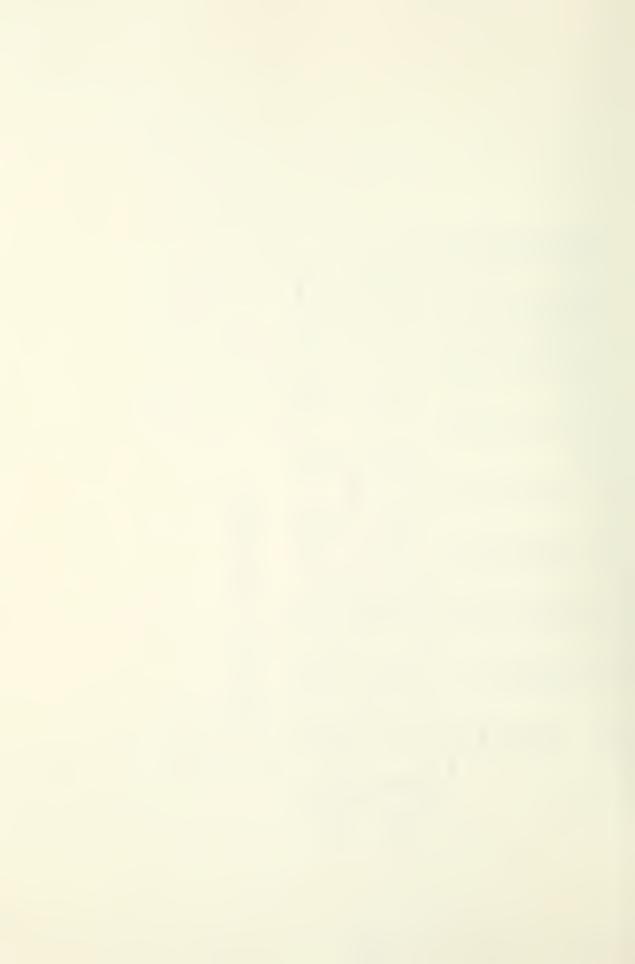
PHIPARY NCZZLE CIAM PIXING STACK LENGTH PIXING STACK CIAPET	FRIMARY ACZZLE CIAMETER: 3.70 IN MIXING STACK LENCTF: 29.25 INCHES MIXING STACK CIAMETER: 11.70 INCH	ETEK: 3.70 INCFES : 29.25 INCHES ER: 11.70 INCHES	S)			AREA RATIC, AV/AP; Orifice diameter; Crifice reta: C.447	,	2.50 6.5C2 IACHES		
PINING STACK L/C:	/C3 2.50					AMEIENT PRESSURE:	ESSURE: 2	29.55 INCHES HG	g	
FCR	OFCF	TCR	TUPT	TAPE	PU-FA	2 4 - 4 9	PA-PT	SECCNDARY AREA		TERTIARY AFEA
INCHES OF	SF HATER	OEGR	DEGREES FAFRENFEIT	INFE 11	IAC	INCPES OF WATER	ER	SCUAFE INCFES		SQUARE INCHES
0.1	22.0	73.3	129.9	5 E . C	6.10	0.0	0.41	****		0.0
C-3	22.C	77.7	130.3	36.0	6.05	0.0	0.25	****		3.142
1.0	22.0	76.8	130.4	96.0	6.C0	0.0	0.16	****		6.263
1.0	22.C	78.5	131.0	96°C	0). 9	0.0	0.05	****		12.566
1.0	22.0	1.11	136.7	98.0	6.05	0.0	50.0	****		18.850
۲٠٥	22°C	77.0	130.7	0.86	0). 9	0.0	0.03	****		25.133
1.0	22.0	6.11	131.0	3.86	6.C5	٥٠٥	0.C2	***		37.659
0.7	22.C	9.11	131.3	58.0	93.9	0.0	0.01	***		50.265
C•3	22°C	17.8	136.9	J.86	0). 9	0.0	J. J	* * * * * * * * * * * * * * * * * * * *	* * *	* * * * * * * * * * * * * * * * * * * *
SECCACARY BCX	٠									
*	ŧ.	<u>*</u>	P * / T *	P 4	<u>4</u>	9; #	٠. د ټ	3	כנ	UPT MACH
					LBY/SEC	LEP/SEC	FT/SEC	FT/SEC	FT/SEC	
******	0.0	0.5459	0.0	****	357.5	****	183,49	****	75.54	0.064
******	0.0	0.5453	0.0	****	3.675	****	182.87	****	75.66	0.064
******	o•c	0.5451	0.0	****	3.671	****	182.71	****	75.61	0.064
******	٥•٥	0.5441	0.0	****	3.672	****	182.55	****	75.71	0.064
*****	0.0	95550	0.0	****	3.675	****	182.55	****	15.73	0.064
******	0.0	95550	0.0	****	3.677	****	162.11	****	75.78	0.064
******	0.0	0.5441	0.0	******	3.674	****	182.05	***	25.35	0.064
*****	J•0	X . 5437	0.0	****	3.674	****	183.14	****	75.75	0.064
*****	0.0	0.5443	0.0	*****	3.675	****	182.04	****	75.75	0.064

TABLE IX (CONTINUED)



* _ =	₽T.	±L	PT*/TT*	44 55.44[[+]4	44 55	7	÷	ÜĒ
					LBM/S SC	LBM/SEC	C FT/SEC	EC FT/SEC
0.0	0.0565	0.5459	0.0598	0.0	2.650	ij	****	* 72.74
C.0142	0.0351	0.5453	0.0372	0.014	3.675	0.05	****	* 72.52
C.0227	C. (225	0.5451	0.0238	0.022	3.671	30.0	****	
C.C341	0.0126	0.5441	0.0134	6.033	3.672	0.13	***	•
C.C381	0.000	C. 5446	0.C074	0.037	3.675	0.14	* * * * *	* 75.31
C.C425	6733.0	97750	0.0052	0.041	3.677	C. 16	****	
C.0482	0.0028	0.5441	0.0030	0.647	3.674	0.16	****	* 76.06
C.0455	0.0014	C. 5437	0.0015	0.044	3.674	C.17	****	35.55
***	0.0	0.5443	0.0	****	3.675	****	****	* 72.56
STACK PR	PIXING STACK PRESSURE CISTRIBUTION FOR KUN:	18UTICN F	CR RUN: 9	PCSITICN A	4			
3,6: 0.0	62.0	C.50	0.75	1.00	1.25	. 50	1.75	2.00
FPS(IN. F2C): 1.410	10 *****	0.700	0.670	0.510	0.37C	*****	*****	C.CEC
FP 54: C.198	***** 86	960.0	0.094	0.072	0.052 ×	* * * * * *	*****	0.011
STACK FR	PIXING STACK PRESSURE CISTRIBUTION FOR JUNE	IBUT ICN F		9 POSITION B	ø			
x/C: 0.0	0.25	0.50	0.75	1,00	1.25	. 50	1.75	2.00
FPS(1h. F2C): 1.410	10 (.610	069.3	00.100	*****	0.390	0.270	*****	0.080
		100						

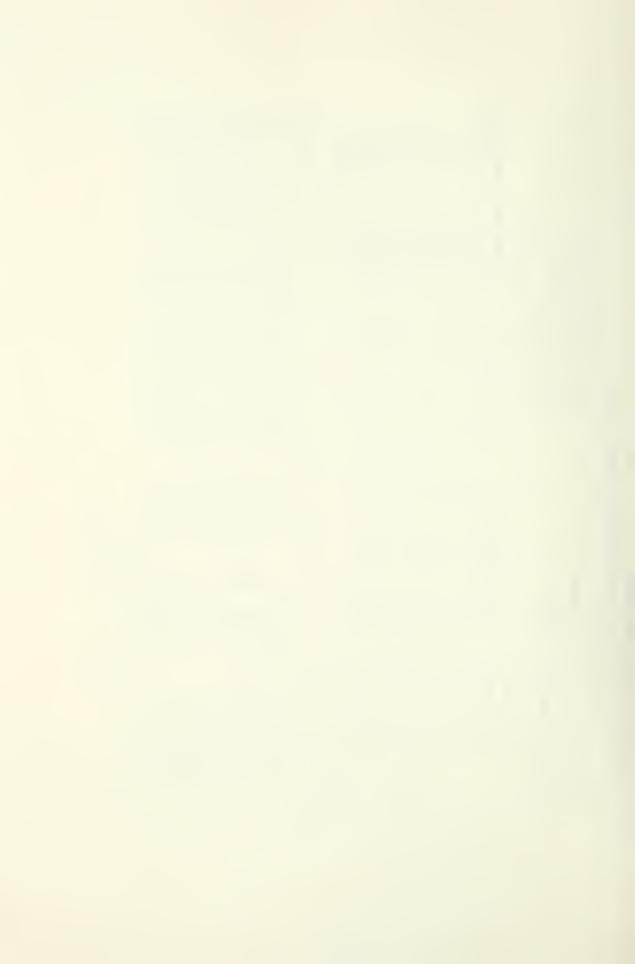
TABLE IX (c) (CONTINUED)



CATA TAKEN CN 7 AUG 1576 EN LEMKE ANG STAEPLI S/C = .5: FCRIEC MIXING STACK, A-1 8-1 G-2 CGNFIGURATIGN, SECONDARY ECX OPEN

CLAPETER: 3.70 INCHES	FFIF	AUX AOXIE										
The property of the property		111101 144		3.70 1NCF	٠,			AREA FATIC	. AMIAE:			
The control of the	V1XI	NG STACK LE		5 INCHES				ORIFICE DI		6.SC2 INCHES		
FCR	¥1×I	NG STACK CI		.70 INCHES				CRIFICE BE	TA: C.457			
FCR	1111	NG STACK L/						AMEIENT PR		29.55 INCHES H	5	
INCPES GF WATER DEGREES FAPRINEIT INCPES CF WATER SCLABE INCPES GF WATER	z	FCR	DFCF	TCR	TUPT	TAPE	PU-PA	PA-FS	PA-FT	SECCNDARY AR		TERTIARY AREA
CCACAPA ECA CCACA	FLN		3	DEGR	EES FAFRE	NETT	INC	HES CF MAT	E.B.	SCLAFE INCHE		SQUARE INCHES
CCNCEPT EC.T 78.2 132.0 102.C 6.1C 0.2G 4************************************	-	0.3		7E.1	133.7	102.C	6.10	0.0	0.45	***		0.0
0.7 22.0 7E.1 132.5 102.0 6.05 C.C 0.15 4************************************	7	6.7		78.2	132.0	102.0	91.9	0.0	95.0	****		3.142
CCNCLR) ECX C.7 22.C 72.1 132.5 102.C 6.C5 0.0 0.1C ************************************	м	0.7		7.31	135.0	102.0	6.10	0.0	0.26	*****		€.283
0.7 22.0 75.3 132.4 102.0 6.05 0.0 0.10 ******************************	4	6.7		76.1	132.5	102.0	6.05	0.0	0.15	***		12.566
CCNCAP1 CC7 C22.0 8C.8 132.4 102.0 6.05 0.0 0.08 ******************************	S	1.0		77.5	132.2	102.C	6.05	0.0	0.10	****		18.850
CCACAPA ECA +++++++++	ę	1.0		75.3	132.4	102.0	6.05	0.0	0.08	****		25.133
CCNCARN ECX	7	6.3	22.0	86.8	132.6	102.0	9.00	0.0	0.04	***		37.659
CCACAPA ECA He Fa Ta Pa/Ta haTas.44 hF hE LE LF UP UL LEM/SEC FT/SEC FT/SEC FT/SEC FT/SEC FT/SEC FT/SEC ***********************************	80	6.3	22.0	76.5	132.5	102.0))·3	0.0	0.03	***		50.265
## F* T* P*/T* h*T**.44 hF h\$ T**.44 hF h\$ LF UF UC ******** 0.C 0.5466 0.0 ******* 2.673 ****** 183.23 ***** 75.66 ******* 0.C 0.5453 0.0 ******* 2.673 ****** 183.23 ***** 75.66 ******* 0.C 0.5453 0.0 ******* 2.673 ****** 183.23 ***** 75.65 ******* 0.C 0.5453 0.0 ******* 3.671 ******* 183.23 ***** 75.53 ******* 0.C 0.5463 0.0 ******* 3.672 ****** 183.45 ***** 75.53 ******* 0.C 0.5463 0.0 ******* 3.674 ****** 183.45 ***** 75.53 ********** 0.C 0.5463 0.0 ******* 3.674 ****** 183.41 ****** 75.53 ********* 0.C 0.5463 0.0 ******* 3.674 ******* 183.41 ****** 75.55 *********** 0.C 0.5463 0.0 ******** 3.672 ******* 183.41 ****** 75.55 *********************************	5	C•1		6.11	132.8	102.0	90.9	0.0	0.0	****	* * * *	*****
### F# T# P#/T# h#T##.44 hF hE LF UP UL LBM/SEC LBF/SEC FT/SEC FT/SEC FT/SEC FT/SEC ######### 0.C 0.5456 0.0 ####### 2.672 ###### 183.21 ###### 75.62 ######### 0.C 0.5453 0.0 ####### 183.21 ###### 75.62 ######### 0.C 0.5453 0.0 ####### 3.671 ###### 183.21 ##### 75.63 ###################################	SECCIO	ARY BCX										
LEP/SEC FT/SEC F	~	*	ŧ	<u>*</u>	P*/1*	h*T**.44	ŭ.	J.	٦,	5	7	UPT MACH
0.C 0.5453 0.0 ******* 2.672 ****** 183.23 ***** 75.66 0.0 0.5453 0.0 ******* 2.672 ****** 183.23 ***** 75.66 0.0 0.5453 0.0 ******* 2.672 ****** 182.23 ***** 75.62 0.0 0.5453 0.0 ******* 3.676 ****** 183.24 ****** 75.53 0.0 0.0 ******* 3.676 ****** 183.24 ****** 75.62 0.0 0.5487 0.0 ******* 3.664 ****** 183.45 ****** 75.62 0.0 0.5483 0.0 ******** 3.664 ******* 183.41 ****** 75.75 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	402						LEM/SEC	LEMISEC	FT/SEC	FT/SEC	F1/5EC	
0.C 0.5453 0.C ******* 2.672 ****** 182.21 ***** 75.62 0.C 0.5453 0.C ******* 2.671 ****** 182.22 ***** 75.62 0.C 0.5465 0.O ******* 3.676 ****** 162.24 ***** 75.53 0.C 0.5487 0.O ******* 3.676 ****** 162.24 ***** 75.62 0.C 0.5483 0.O ******* 3.676 ****** 182.05 ***** 75.75 0.C 0.5485 0.O ******* 3.672 ****** 182.01 ****** 75.75 0.C 0.5485 0.O ******* 3.672 ****** 182.41 ****** 75.75 0.C 0.5485 0.O ******** 3.672 ******* 182.41 ****** 75.50 0.C 0.5485 0.O ******** 3.672 ******* 182.41 ****** 75.50 0.C 0.5485 0.O ********* 3.672 ******* 182.41 ******* 75.50 0.C 0.5485 0.O ********** 3.672 ************ 182.41 ******** 75.50 0.C 0.5485 0.O ***********************************		*****		9955.0	0.0	*****	2.674	*****	183.E5	* * * * *	76.CB	0.064
C.C 0.5453 0.0 ********* 3.671 ******* 182.22 ****** 75.53 0.C 0.5465 0.0 ******** 3.676 ******* 182.48 ****** 75.53 0.C 0.5487 0.0 ******** 3.665 ******* 182.45 ****** 75.52 0.C 0.5487 0.0 ******** 3.665 ****** 182.45 ****** 75.62 0.C 0.5483 0.0 ******** 3.672 ******* ****** 75.75 0.C 0.5485 0.0 ********* 3.672 ******* ******* 75.50	2	****		6545.0	0.0	*****	2.612	*****	183.31	****	75.66	0.064
0.C 0.5465 0.0 ******* 2.672 ****** 182.48 ***** 75.53 0.C 0.5490 0.0 ******* 3.676 ****** 182.45 ***** 75.54 0.C 0.5487 0.0 ******* 3.664 ****** 182.45 ***** 75.75 0.C 0.5485 0.0 ******* 3.672 ****** 182.41 ***** 75.75	~1	****	J•3	6545.0	J.0	*****	3.671	*****	183.22	* * * * *	75.82	0.064
0.C 0.5487 0.0 ******* 3.67¢ ****** 182.45 ****** 75.62 0.C 0.5487 0.0 ******* 3.66¢ ****** 182.41 ***** 75.75 0.C 0.5463 0.0 ******* 3.66¢ ****** 182.41 ***** 75.75 C.C C.5485 0.0 ******* 3.672 ****** 182.41 ****** 75.75	4	*****		0.5485	0.0	******	3.673	*****	163.48	****	75.53	0.064
0.C 0.5487 0.0 ******* 3.665 ****** 165.24 ***** 75.82 0.C 0.5463 0.0 ******* 3.664 ****** 182.45 ***** 75.75 C.C C.5485 0.0 ******* 3.672 ****** 182.41 ***** 75.50	S	*****	J•0	0.5490	0.0	*****	3.676	****	183.45	****	75.54	0.064
0.C 0.5463 0.0 ******* 3.664 ****** 182.05 ***** 75.75 C.C C.C.5485 0.0 ******** 3.672 ******* 182.41 ****** 75.50	Ų	****	0.0	0.5487	0.0	*****	3.665	*****	163.24	****	75.63	0.064
C.C. C. 5485 G.G ******* 3.672 ****** 183.41 ****** 75.50	7	****	0.0	0.5463	0.0	*****	3.664	****	183.05	*****	25.75	490.0
	80	*****	٥•٠	.C. 54 85	0.0	****	3.672	****	182.41	* * * * *	75.50	0.064
****** T3:101 ******	پ	*****	J.0	0.5480	0.0	******	2.674	****	183.61	*****	15.58	0.064

TABLE IX (CONTINUED)



UE	F1/SEC	72.88	73.86	14.73	75.87	76.64	77.15	77.81	78.41	72.78								
à	FT/SEC	*****	****	****	*****	****	****	*****	****	****		2.00	0.07	0.010		2.00	0.080	0.011
_		-	-	•	•	•	-	-	•	_		1.75	****	****		1.75	*****	*****
L	Lerisec	3:	6.06	C-11	C-16	0.20	C • 23	0.26	C.25	***		1.50	****	****		1.50	0.300	0.042
¥ 5	L8M/StC	3.674	3.673	3.671	3.672	3.676	3.669	3.664	3.672	3.674			-	_				
HT+TT++.44 NF	F.8			89	17		13	11	11	:	I ION A	1.25	0.350	0.045	10N B	1.25	0.435	0.061
		0.0	0.016	0.028	C . C 4 2	0.652	0.061	11.0.0	0.077	***	9 POSITION A	1.00	0.410	0.056	9 PCSITION B	1.00	* * * * *	***
P14/TT*		0.0666	0.0457	C. C386	0.0215	0.0148	0.0111	1903.0	0.0045	0.0		0.75	C.520	0.073		d.75	0.530	0.074
*11		99550	0.5493	0.5493	0.5485	0.5490	0.5487	0.5483	X . 5485	0.5460	PIXING STACK PRESSURE EISTRIBUTION FUR RUN:	05.0	0.650	0.091	PIXING STACK PRESSURE CISTRIBUTION FOR RUN:	0.50	0.580	C .081
FT		0.0630	0.6472	0.0367	C.C204	0.0141	0.0106	0.0064	0.0042	J.C	LRE CISTR	(.25	****	***	LAE CISTR	92.0	1,766	6.058
* 13		٥٠٠	0.0164	C: C2 8 S	C.C431	C.0537	C.0621	0.0723	6.6785	****	ACK PRESS	0.0	1.280	C-180	ACK PRESS	0.0	1.260	771.0
	_	=	-	-	-		-	-	-	*	IXING ST.	:3/1	FPS(IA. F2C):	F P.S.4.3	IXING ST.	x/C:	FPS(IN. F2C):	FP.S#:
4	RUA	1	2	m)	4	5	•	7	60	•	•		FP5(18.		•		FPS(IN	

TEFTIARY BOX

TABLE IX (d) (CONTINUED)



(ATA TAKEN ON 7 ALG 1578 BY LEMKE AND STAEHLI S/C **!: FCRTEC PIXING STACK, A-1 B-1 C-2 D-2 CONFIGURATION, SECONCARY BOX OPEN

	TERTIARY AREA SCUARE INCHES	0.0	3.142	6.283	12.566	18.850	25.133	37.699	50.265	***		UPT MACH		0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064	
9										*		UL	F1/5EC	75.65	15.81	75.66	75.65	75.62	15.78	75.50	75.75	15.89	
2.50 INCFES 2.50 4.5C2 INCHES 25.55 INCHE 8 HG	SECCNDARY AREA Scuare incres	***	****	*****	*****	****	***	***	***	****		à	F1/SEC	****	* * * * *	* * * * *	* * * * *	****	****	****	***	****	
HETER: 11. , JP/JF: APETER: 6 TA: C.457 ESSURE: 2	PA-PT EF	0.42	0.32	0.25	0.Ié	0.11	90.0	0.05	0.03	0.0		L.F.	F1/SEC	183.37	183.18	162.68	163.28	183.22	183.12	183.40	183.13	182.37	
UFTAKE CIPMETEF: 11.50 INCPES AREA FATIC, PF/FF: 2.50 ORIFICE DIAPETER: 6.5C2 INCH CRIFICE BETA: C.457 AMEIENT PRESSURE: 25.55 INCH	PA-PS INCPES CF WATER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		93	LPM/SEC	*****	*****	****	****	****	****	****	****	*****	
	PU-FA INCI	6.10	6.10	6.05	03.9	93.9	6.05	03.9	22.3	9.60		7	Lew/SEC	3.677	3.676	3.671	2.674	3.670	3.673	3.676	3.671	3.645	7
	TANE IHEIT	102.0	102°C	162.6	102.C	102.0	102.0	102.C	102.C	102.C		>> ** L + 4		*****	*****	*****	*****	*****	*****	*****	****	****	C-2, D-2 CONFIGURATION
S .	1 TLPT TA	131.6	131.2	130.5	131.8	132.2	131.4	131.9	131.7	132.8		P*/T*		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	CONFIG
CZZLES: 4 ETER: 3.70 INCHES ; 29.25 INCHES ER: 11.70 INCHES 2.50	TCA DEGA	11.1	17.5	76.7	76.0	15.1	78.2	77.5	78.7	15.3		*		6655.0	0.5506	0.5511	9655.0	0.5490	C.5503	0.5495	6.5458	0.5480	2, D-2
RY NC ZZLES: CIAPETER: AGTP: 29.25 APETER: 11. C: 2.50	CPCR F hater	22.0	22.C	22.0	22.0	22.0	22.0	22.0	22.0	22°C		ī		0.0	0.0	٥٠٠	٥.0	0.0	٥.٥	0.0)•0	0.0	B-1, C-
NUPEER OF FRIHARY N PRIFARY NCZZLE GIAP PIXING STACK LENGTH PIXING STACK CIAPET PIXING STACK CIAPET	FCF INCHES CF	۲.0	0.7	0.7	0.7	0.7	0.7	0.7	7.0	C- 3	A) ECX	*		***	****	*****	*****	*****	*****	*****	*****	***	A-1, I
P P P P P P P P P P P P P P P P P P P	R N	-	7	m	4	٧.	9	۲	8	5	SECCACARY	4	RUA	-	7	m	4	vn	ç	۲	IJ	5	(e)

TABLE IX (CONTINUED)



2	**	FT.	*L1	PT*/TT*	hT*TT**.44	7 4	=	5	÷	ij.
RUA						LBM/S.C	Lev/sec		FT/SEC	FT/SEC
-	0.0	0.0584	0.5499	0.0615	0.0	3.677	0.0	*	****	72.65
13	C.0161	95450 1	C.5506	0.0475	0.016	3.676	93.0	*	****	13.78
71	C.C2E3	9 0.0354	0.5511	C.0372	0.028	3.671	0.10	****	* * *	74.55
4	5773	. 0.C221	96550	0.0233	6.644	3.674	(.16	*****	*	75.92
u۱	C.0567	7 0.0157	0.5490	0.0165	0.055	3.670	0.21	****	* *	76.75
ę	C.C637	7 0.0112	C.5503	0.0117	0.062	3.672	C • 23	****	*	77.22
7	0.0744	. 0.0068	0.5495	0.0011	C.C73	3.676	15.0	*****	*	78.11
6 0	C.C826	8+33°3 ;	0.5498	0.0051	0.082	3.671	C.31	****	* *	78.66
۰	*****	0.0	0.5480	0.0	****	3.665	***	****	*	72.65
• 1X 1A	C STACK PE	PIXING STACK PRESSURE EISTRIBUTION FCR RUN:	RIBUTION F	CR RUN: 5	9 PCSITION A	⋖				
^	3.C: 0.0	(.25	C-50	97.0	1.00	1.25	1.50	1.75	2.00	
FPS(IN. F2C):		1.220 *****	0.610	0.433	0.340	0.271	****	****	0.061	_
1	FPS#: 0.1	0.172 *****	980*0	0.061	0.046	0.038	****	* * * * * *	0.011	_
PIXIA	G STICK PR	PIXING STACK PRESSURE CISTRIBUTION FOR HUN:	R IBUTICN F		9 PCSITION B	89				
×	x/C: 0.0	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	
FPS(IN. F2C):		1.240 C.67C	005.0	0.463	****	0.398	0.278	****	0.00	
3.	F 1 1 0	0.175 C.054	0,00	370 0	1 1 1 1 1	730	000	11111	•	

TABLE IX (c) (CONTINUED)



~ 4	LPEER (ALPEER CF PRIMARY FFIPARY NOZZLE CI	ACZZLES Apeter:	3.70 INCHES	ES			LPTAKE EIA AREA RATIC	CPTAKE CIAMETER: 11.5G INCHES Area ratic, am/ap: 2.5C	5c INCHES		
2.4	PIXING S	TACK LEN	MIXING STACK LENGTH: 28.25 INCHES	INCHES 70 INCHES				ORIFICE OIAMETER:	AMETER: 6	6.902 INCHES		
· I	17 1NG	HINING STACK L/O:	. 2.41	STATE OF				APSIENT PRESSURE:	ESSURE: 2	25.55 INCHES HG	Э Н	
z		POR	OPCR	108	TUPT	TARE	PU-PA	PA-PS	PA-FAZ	SECCNCIRY AREA	AR EA	
P.	_	INCHES CF	HATER	0EGR	DEGREES FAHRENHEIT	4+E1T	Ŋ	INCHES OF WATER	ER	SCUAPE INCHES	ĒŠ	
1		C.7	0.55	5.75	10E.C	999	2.65	3.74	3.74	0.0		
Ž		C-7	25.0	54.5	168.5	J.89	3.60	2.63	2.64	12.566		
C)		1.0	22.0	54.5	108.5	0.89	4.25	1.53	1.53	25.133	•	
4		1.0	22.0	55.0	168.5	68.0	2.00	1.16	1.14	50.265	10	
uı		7.0	22.0	54.5	108.5	68.0	5.60	0.46	95.0	100.531		
9		0.7	22.0	55.0	166.5	6 E . C	5.75	0.27	6.27	150.756		
7		0.1	22.C	55.0	106.5	9.89	5.65	0.16	0.16	201.062		
89		1.0	22.0	55.0	101.5	0.39	5.90	C.1 C	0.10	245.044		
6		٥٠٦	22°C	55.0	106.0	0.89	00.9	C.C2	0.02	****		
z		*	*	<u>*</u>	P*/T*	55" **[*#	đ	S.H	<u>د</u>	3	دد	UPT MACH
FLA							L EM / SEC	LEMISEC	F 1 / SEC	F1/SEC	F1/5EC	
1		0.0	0.5046	9625.0	0.5428	o.c	3.757	0.0	181.57	72.59	75.14	3.064
(3)	_	C.1656	C-3561	C. 5287	0.2835	C.1757	3.757	0.657	161.23	84.87	75.00	0.064
e)		0.3175	3.2623	C.5287	0.2824	6.36.3	3.757	1.153	160.52	53.56	74.87	0.064
4		C.48E2	0.1584	6.5287	0.1705	0. :726	3.755	1.833	186.45	104.75	24.65	0.064
u1	_	C.6155	0.630	0.5287	0.0678	0.6661	3.757	2.325	186.26	113.52	34.66	0.064
4	•	C.7128	0.6370	0.5287	0.0359	2359.3	3.755	2.676	180.09	115.64	74.53	0.064
7		C.7316	0.520	0.5287	0.0236	0.7082	3.755	2.747	180.04	120.87	74.51	0.064
89		6,7649	0.0137	0.5287	0.0148	0.6823	3.755	2.647	186.02	115.08	74.50	0.064
φ.	•	******	0.0028	0.5255	0.0030	******	3.755	****	175.82	* * * * * * * * * * * * * * * * * * * *	74.42	0.064
¥1.4	INC ST	PIXING STACK PRESSU	LRE CISTRI	RE CISTRIBLTICN FOR PUR:		9 FCS1110N A	A Z					
	:)/(0.0	9.55	0.50	C.75	1.00	1.25	1.50				
FPS(11. +2C):	11324	2.580	*****	1.520	1.390	1.310	1.250	****				
	F 5.4 :	0.410	****	0.209	0.191	0.1EC	0.177	****				
X	UNG ST	ACK PRESS	MIXING STACK PRESSURE OISTRIBUTION FOR RUN:	BUTICN FO		9 POS1T 10N B	00 Z					
	:0/(0.0	0.25	x • 50	0.75	1.00	1.25	1.50				
PASC IN. 12C1:	1561:	2.970	1.540	1.380	1.390	* * * * * *	1.350	1,310				
	F P.S.4:	605.0	C.212	0.190	0.191	*****	0.151	C. 1 EC				
(a)	TER	TERTIARY	BOX CLOSED	OSED								
	:	- [1	i	1		1		3	(

PERFORMANCE DATA FOR THE PORTED MIXING STACK WITH TWO-RING DIFFUSOR

TABLE X.

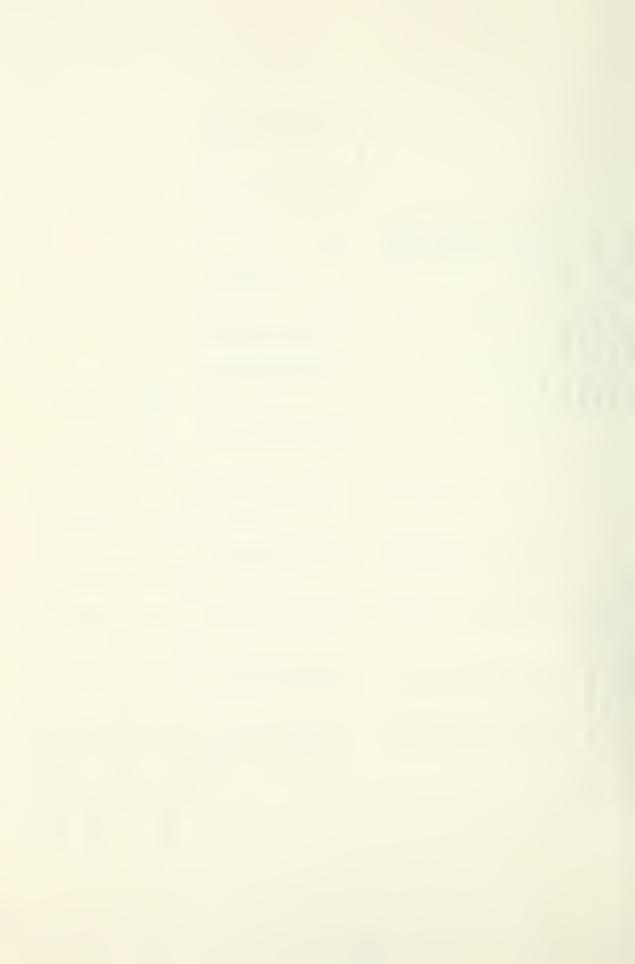
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NIPEER	NIPEER OF PRIMARY	N ACZZLES:	4 6	;			LPTAKE DIAMETER: 11.5C INCHES	PETER: 11.	SC INCHES		
70 to 1 to 2	_	AAFE GA:	LONG DATE	2			AKED KPITC, PF/PF.		06.5		
BAIKIN		STACK LENGIF; 28-25 INCHES	INCHES				URIFICE OIAPETERS	AMETERS 6	6.5CZ INCHES		
DALKIN	SIACK CIA	-	C INCHES				CRIFICE BEID: C.457	155.5 : 41	4	•	
a r r r r	SIACA LILE	74.7					AREIENI PRESSUREI		24.55 INCHES NO	د ع	
z	PCR	DFCR	TCR	TUPT	TAPE	PU-FA	PA-PS	FA-FNZ	SECCNEARY AREA	AREA	
F.L.	INCHES CF	h A T E R	DEGR	DEGREES FARRENFEIT	IFEIT	1N(INCHES OF WATER	ER	SCUAFE INCFES	FES	
1	1.0	3.55	55.0	108.0	9.39	3.15	3.26	3.26	0.0		
2	0.7	22.0	55.0	108.5	99	4.18	2.16	ž. 15	12.566	ę	
9	7.0	22.0	55.5	10E.5	J• 8 9	4.75	1.48	1.48	25.133	9	
4	C-3	22.0	55.5	108.5	0.89	5.45	0.81	0.81	50.265	u1	
uı	1.0	22.0	55.5	109.0	9.89	5.80	C-21	C.31	100,531	1	
9	2.0	22.0	56.0	105.0	9.89	2.50	C.17	0.17	150.756	ų	
7	C.7	22.0	5 6 5 9	165.0	9.89	5.95	0.10	0.10	201.062	2	
æ	1.0	22.0	56.0	105.0	66.0	6.00	53.3	0.07	545.044	4	
v	0.7	22°C	55.5	105.0	9.39	6.05	0.01	0.01	***		
Z	# .£	#	*	F#/T#	64.4.144	u.	J.	LF	Š	ಕ	LPT MACH
RCA						LBM/SEC	LEMISEC	F1/SEC	F1/SEC	FT/SEC	
1	0.0	0.4413	9625.0	17170	0.0	3.755	0.0	181.26	72.47	75.01	6.064
2	6.1676	0.2535	0.5287	C.3160	0.1622	3.755	523.0	166.53	83.54	74.EE	0.064
e)	C.2783	0.2020	C.5287	0.2175	0.2654	3.753	1.044	186.54	50.77	74.71	0.064
4	C.4117	0.1109	C. 5287	0.1134	0.3565	3.753	1.545	186.24	55.56	74.55	0.064
u1	C.5054	0.6425	0.5279	0.0458	5254.0	3.753	1.512	160.16	166.06	14.57	0.064
•	C.5661	0.0233	6.5279	0.0251	0.5476	3.751	2.124	186.03	105.77	74.50	0.064
7	(.5787	0.(137	C. 5279	0.0148	5555.0	3.753	2.172	160,05	116.65	74.53	0.064
60	C.5503	9500.0	0.5239	C.C104	0.5712	3.751	2.214	175.55	111.37	14.45	0.064
5	******	C.CC14	0.5279	0.0015	****	3.753	****	180.05	* * * * *	74.51	0.064
PIXING S	PIXING STACK PRESSURE CISTRIBLTION FOR RUN:	URE CISTRI	BLTICN FO		9 FCSITION A	۷ 2					
:) / C	0.0	52.0	0.50	27.0	1.00	1.25	1.50				
FPS(IN. P2C):	1.570	*****	0.190	093.0	C.56?	\$ 205.0	***				
FP.543	0.215	***	0.108	0.091	0.017	\$ 590.0	* * * * * *				
MIXING S	MIXING STACK PRESSURE OISTRIBUTION FOR RUN:	LRE OISTRI	BUTICN FC		9 POSITION 8	о 2					
x/E:	0.0	0.25	05.0	0.75	1.00	1.25	1.50				
FPS(1N. F20):		(.810	069.0	0.670	****	099.0	955.0				
5	0.224	0.111	0.095	C.C92	***	0.091	0.062				
(b) TER'	TERTIARY, BO	OX OPEN		(SECONDARY	PUMPING)	IG)					

TABLE X (CONTINUED)

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CATA TAKEN ON 14 AUGLST 1578 BY LEPKE AND STAEHLI S/C *.5; FCRTEC STACK hITP 2 RING CIFF. (A-1 B-1 C-2 D-2); TERTIARY 80% OPEN

221	PIXING STACK LENGTF; 28.25 INCHES PIXING STACK CIAPETER: II.70 INCH PIXING STACK L/C: 2.41	ENGTH: 28.2 IAMETER: II /C: 2.41	: 28.25 INCHES ER: II.70 INCHES 2.41	***			ORIFICE DIAMETER: CRIFICE BETA: C.457 AMELENT PRESSURE:		6.5C2 INCHES 7 29.55 INCHES HG	ပ္	
z	FCR	DFCF	TCR	TLPT	TAME	PU-PA	PA-PS	FA-F1	SECCNEARY AREA		TERTIAFY AREA
FLA	INCFES	CF WATER	CEGR	CECREES FAFRENHEIT	NHEIT	INC	INCHES OF WATER	E.	SCLAFE INCPES		SQUAFE INCHES
	0.1	22.C	54.0	106.0	6E.C	03.9	20.0	0.58	***		0.0
2	0.1	22.0	54.0	108.0	6€. C	93.9	0.02	0.63	***		3.142
m	1.0	22.0	54.0	108.0	éE.C	03 . 9	0.02	0.72	***		6.283
4	0.7	22°C	54.0	108.0	68.C	6.00	0.02	0.53	计算者的计算的		12.566
2	0.7	22.0	54.0	108.0	6 £ • C	33.9	C.02	0.41	计会会会会会会会会		18.850
9	0.1	25.0	55.0	108.0	0.89	6.00	0.02	0.32	***		25.133
1	6.7	22.0	55.0	108.5	3.89	0J•9	0.02	17.0	***		37.699
89	1.0	22.0	54.0	106.0	6E.C	6.00	53.3	0.14	***		50.265
پ	۲•٥	22°C	54.0	108.0	9.89	0J.9	0.02	20.0	****	* *	****
SECC	SECCNCARY ECX										
4	*	# CL	<u>*</u>	P*/T*	h = 1 = + 4 4	Ŧ	u;	L.F	Š	J,	UPT MACH
RUP						LEMISEC	LEMISEC	FT/SEC	FT/SEC	F1/5EC	
-	****	3.0027	0.5295	0.0030	*****	3.758	****	180.00	***	34.45	0.064
(3	****	0.0027	0.5255	0.0030	****	3.758	****	186.00	****	24.45	0.064
a,	***	0.0027	0.5255	0.030	*****	3.758	****	186.00	***	14.45	0.064
4	***	0.0027	0.5255	0.0030	*****	3.758	****	180.00	***	34.45	0.064
ιn	***	C.CC27	0.5295	0.0030	***	3.758	****	180.00	****	14.45	0.064
ç	****	0.0028	0.5295	0.0030	****	3.755	****	175.82	****	74.42	0.064
7	***	0.0027	0.5287	0.0030	***	3.755	****	175.98	****	14.48	0.064
	***	0.0027	ۥ 5295	0.0030	***	3.758	****	180.00	****	34.45	0.064
Ç	*****	0.0027	0.5295	0.0030	****	3.756	***	180.00	***	14.49	0.064

TABLE X (CONTINUED)



U.E	FT/SEC	****	****	****	****	*****	****	****	****	****								
	ш.	*	*	*	*	:	*	*	*	*								
ž	FT/SEC	****	***	****	****	****	* * * * *	****	***	***								
7	LBY/SEC) • <u>)</u>	C-1C	C. 16	C.31	0.41	(.45	55.0	. 59*)	****		1.50	****	****		1.50	0.610	0.084
4 4 4	LBH/Sic	****	****	****	*****	*****	*****	****	****	***	4	1.25 1	. 005.0	¥ 590°0	æ	1,25 1	0.670	260.0
MT+TT++.44 hV		0.0	0.025	0.047	0.061	0.166	0.125	C+152	0.166	***	9 PCSITION A	1.00 1	0.570	0.076	9 POSITION B	1.00	****	***
*11/*1d		0.1447	0.1226	C.1063	0.0783	9090.0	0.0474	0.0310	0.0207	0.0030		0.75	099.3	0.051		9.75	0.470	.*63*0
* 11		0.5295	0.5295	0.5295	5625.0	0.5295	0.5295	0.5287	XQ.5295	0.5295	PIXING STACK PRESSURE CISTRIBUTION FOR RUN:	05.3	0.810	0.111	PIXING STACK PRESSURE CISTRIBUTION FOR RUN:	0.50	0.710	160.0
#T4		0.1345	0.1135	6.6588	0.0728	0.0563	0.640	3.6268	C•(152	6.00.0	LRE CISTR	(• 25	****	* * * * *	LRE CISTR	0.25	(.820	C•113
* 1.		0.0	C.0260	(.0465	C.0831	C.1C57	C.1253	0.1572	C.17CS	******	ACK PRESS	0.0	1.550	C.218	ACK PRESS	0.0	J. 4 EC	C.231
~	RUA	-	~	r)	4	۷١	رب		æ	5	PIXING ST	:)/(FPS(116. F2C):	10044	PIXING ST.	x/C:	FP5(116. F2C):	* #5.4.5

TEFTIFR EOX

TABLE X (c) (CONTINUED)



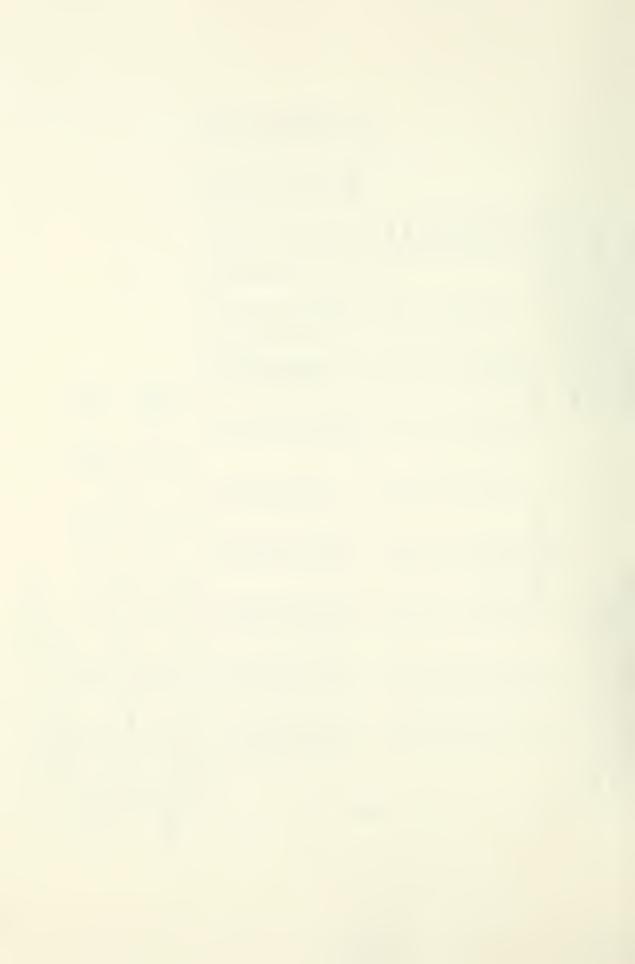
																LPT PACH		0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064									
				ЭН	AREA	FES		ę	61	41	-	ę	2	4	*	บ	FT/SEC	55.21	75.66	75.65	100	75.48	75.35	75.41	75.26	75.38									
SO INCHES	2.50	6.502 INCHES		29.58 INCHES HG	SECCNDARY AREA	SCUARE INCHES	0.0	12.566	25.133	50.265	100.531	150.756	201.062	245.044	***	3	F1/5EC	72.41	E 5 . 4 5	94.57	1C6.5C	116.48	115.47	122,63	123.12	****									
ETER: 11.		IPETER: 6.	IA: C.497		PA-PNZ	<u>.</u>	3.34	2.52	1.50	1.16	0.49	0.25	0.16	0.11	0 • C2	ر د د	F1/5EC	183.62	182.83	182.50	162.54	182.40	162.06	182.22	182.11	182.16									
UPTAKE DIAMETER: 11.50 INCHES	AREA FATIC, AMIFE	ORIFICE DIAMETER:	CRIFICE BETA: 0.497	AMBIENT PRESSURE:	PA-PS	INCHES OF MATER	3.34	2.52	1.50	1.16	5 5 0	0.25	0.16	0.11	70.0	S	LEP/SEC	0.0	699°0	1.162	1.616	2.361	2.529	2.658	2.726	***		1.50	****	****		1.50	. 355	0 132	
,	•	Ū	_		PU-FA	INC	3.00	2.65	4.25	4.90	5.65	5.80	5.50	9°° 5	6. CC	G.	LBMISEC	3.656	3.651	3,656	3.658	3.710	3.700	3.702	3.701	3.703	V	1.25 I.	0.950	0.138 **	au -		ပ		
					TAME	HEIT	88.0	88.0	96°C	8€.€	88.0	98°C	9 E ° C	86.6	88.0	99° ##1##		0.0	0.1762	0.3055	0.4.773	C. 6151	0.6647	0.7684	C.7162	****	9 PCSITICN A	1.00	1.070	0.145	FCSITION E	1.00	*	*****	
	ES				11.PT	DEGREES FAHRENHEIT	125.0	124.5	124.5	124.5	123.0	124.0	124.0	124.0	124.0	P*/T*		C.4877	0.3708	0.2754	C.1712	0.0723	0.0371	0.0237	0.0163	0.0030		27.0	1.150	0.160	R RUN: 9	0.75	1.040	0.145	
٧.	3.70 INCHES	5 INCHES	STACK DIAMETER: 11.70 INCHES		TCR	DEGR	72.0	72.5	71.5	71.5	0.89	71.0	70.0	76.5	76.0	*		1985.0	0.5375	0.5375	0.5375	6685.0	0.5383	C. 5383	0.5383	0.5363	PIXING STACK PRESSURE CISTRIBUTION FOR RUN:	0.50	1.210	0.168	MIXING STACK PRESSURE DISTRIBUTION FOR RUN:	0.50	1.150	0.160	CLOSED
Y ACZZLES:	1APETER:	STACK LENGTH; 29.25 INCHES	FETER: 11.	2,50	CFCR	h A T E R	22.0	22.0	22.0	22.0	22°C	22.0	22°C	22°C	22.0	*		C.4568	0.3476	0.2619	(*1605	6192.0	0.0348	0.0222	0.0153	0.0028	LAE CISTR	0.25	****	****	LRE DISTR	0.25	1.320	0.183	BOX
NLABER CF PRIMARY	PRIPARY NCZZLE CIA	STACK LEN	STACK DIA	HIXING STACK L/D:	FCF	IACHES OF	1.0	1.0	7.0	6.7	7.0	0.7	0.7	7.0	0.7	:		٥•٥	(.1£13	C.3142	(.4511	C-6362	C.6836	C.72E5	C.1365	*****	TACK PRESS	ن د	****	*****	IACK PRESS	0.0	****	* * * * *	TERTIARY
ALPER	PRIPARY	PIXING	FIXING	HIXING	z	RUN	-	2	r)	4	s,	•	7	80	σ	2	RUA	1	12	m	4	ري د	•	7	3	5	PIXING ST	: 3/4	FPS(IN. PZC):	1 4544	MIXINE ST	X/C:	PPS(IN. +2C):	FPSAG	(a) T

PERFORMANCE DATA FOR THE PORTED MIXING STACK WITH TWO-RING DIFFUSOR AND SHROUD TABLE XI.



MACK CANACATER 11.70 MCHES MACK CANACATER MCK CANACATE	CALIFOLE STATE LANGES CALIFOLE COMMETER: 4:502 INCHES	Ü ²	NLPEER CF PRIMARY FF1P/FRY NOZZLE CIA	r NCZZLES: IAPETER:	NCZZLES: 4 METER: 31.7C INCHES	ES			LPTAKE CIAMETER: 11. AREA RATIO, AP/AP:	-	.50 INCHES 2.50		
PCR TCR TUPT TAPE PAPPS PAPP	PCR TCR TUPT TAPE PU-FA Pu-PS Pu-P	1¥0 1¥0	K LEN	(T +; 25.25 ÆTER: 11.	INCHES 170 INCHES				CRIFICE 01	-	SC2 INCHE		
PCR TCR TUPT TAPE NO-FAS PAPPE PAPP	PCR TCR TUPT TAPE PU-FA Pμ-PS Pμ-P	1 A C	× 1/5						AMEIENT PR		S.SE INCHES	9 H.C	
ATER TECREE FAHRENHEIT INCHES CF NATE SCUAFE INCHES 2.6 71.0 122.5 86.0 3.40 2.65 2.65 0.0 2.0 65.0 122.5 86.0 4.55 1.61 1.51 0.0 2.0 65.0 122.5 86.0 4.55 1.61 1.51 1.5706 2.0 65.0 122.5 86.0 5.20 0.94 0.54 1.51 2.0 65.0 122.5 86.0 5.20 0.94 0.54 1.61 2.0 10.2 122.6 86.0 5.20 0.95 1.03 1.03.63 2.0 10.2 122.0 88.0 5.20 0.15 0.95 1.03 <th>ATER OEGREES FAHRENHEIT Inches CF hate SCUAFE INCHES 2.C 71.0 123.0 88.0 3.40 2.85 2.65 0.00 2.0 65.0 122.5 88.0 4.55 1.21 1.21.708 0.00 2.0 75.0 122.5 88.0 4.55 1.21 1.21.708 0.26.71 2.0 70.0 122.5 88.0 5.2C 0.94 0.54 152.74 2.0 70.0 122.5 88.0 5.2C 0.94 0.95 103.613 2.0 70.0 122.5 88.0 5.2C 0.94 0.95 103.613 2.0 122.5 88.0 5.2C 0.95 0.19 103.613 2.0 122.5 88.0 5.2C 0.95 0.11 0.11 103.613 2.0 122.5 88.0 5.2C 0.05 0.11 0.11 103.61 103.61 2.0 122.5 88.0 5.2C 0.05</th> <th>Ď</th> <th>œ</th> <th>CPCR</th> <th>TCR</th> <th>TUPT</th> <th>TAPE</th> <th>PU-FA</th> <th>3 d-4 d</th> <th>PA-FAZ</th> <th>SECCNOAFY</th> <th>PRE</th> <th></th>	ATER OEGREES FAHRENHEIT Inches CF hate SCUAFE INCHES 2.C 71.0 123.0 88.0 3.40 2.85 2.65 0.00 2.0 65.0 122.5 88.0 4.55 1.21 1.21.708 0.00 2.0 75.0 122.5 88.0 4.55 1.21 1.21.708 0.26.71 2.0 70.0 122.5 88.0 5.2C 0.94 0.54 152.74 2.0 70.0 122.5 88.0 5.2C 0.94 0.95 103.613 2.0 70.0 122.5 88.0 5.2C 0.94 0.95 103.613 2.0 122.5 88.0 5.2C 0.95 0.19 103.613 2.0 122.5 88.0 5.2C 0.95 0.11 0.11 103.613 2.0 122.5 88.0 5.2C 0.05 0.11 0.11 103.61 103.61 2.0 122.5 88.0 5.2C 0.05	Ď	œ	CPCR	TCR	TUPT	TAPE	PU-FA	3 d-4 d	PA-FAZ	SECCNOAFY	PRE	
2.0 3.40 3.45 2.85 2.85 0.0 2.0 65.0 122.5 86.0 4.05 1.14 1.51 15.708 2.0 65.0 122.5 86.0 4.55 1.61 1.61 15.708 2.0 170.0 123.5 88.0 5.20 0.94 0.94 0.95 2.0 10.5 122.0 88.0 5.20 0.15 0.94 0.95 2.0 10.5 122.0 88.0 5.20 0.15 0.95 103.47 2.0 122.0 88.0 5.20 0.15 0.95 103.47 2.0 122.0 88.0 5.50 0.15 0.15 155.25 2.0 122.0 88.0 5.50 0.11 0.15 156.20 2.0 122.0 88.0 5.50 0.11 0.15 156.20 2.0 122.0 88.0 5.50 0.11 0.15 156.20 2.0	2.0 65.0 122.5 86.0 3.40 2.65 2.14 2.14 15.108 2.0 65.0 122.5 86.0 4.05 2.14 2.14 15.108 2.0 71.0 122.0 88.0 5.20 0.94 0.94 5.217 2.0 70.0 122.5 88.0 5.20 0.95 0.95 0.95 103.47 2.0 70.0 122.5 88.0 5.20 0.95 0.95 103.47 2.0 70.0 122.5 88.0 5.20 0.15 0.15 152.528 2.0 71.0 122.5 88.0 5.90 0.15 0.15 152.528 2.0 71.0 124.0 88.0 5.90 0.15 0.10 0.11 1.00.1 1.00.20 2.0 71.0 124.0 88.0 5.90 0.15 0.10 0.11 1.00.1 1.00.20 2.0 71.0 124.0 88.0 5.50 0.11 0.11 1.00.1 1.00.20 2.0 71.0 124.0 88.0 5.50 0.11 122.1 122.2 12	9		WATER	OEGR	EES FAHRE	NFEIT	I	CHES OF NAT	ER	SCUAFE INC	FES	
2.0 65.0 122.5 86.C 4.05 2.14 2.14 15.708 2.0 65.0 123.0 88.0 4.55 1.61 1.61 26.274 2.0 69.0 123.5 88.0 5.2C 0.94 9.34 77 2.0 10.5 124.0 88.0 5.90 0.15 0.15 103.61 2.0 10.5 122.0 88.0 5.90 0.15 0.15 103.61 2.0 10.5 122.0 88.0 5.90 0.15 0.15 103.61 2.0 122.0 88.0 5.90 0.15 0.15 0.15 0.15 2.0 122.0 88.0 5.90 0.15	2.0 65.0 122.5 6E.C 4.05 2.14 2.14 15.708 2.0 120.6 86.0 86.0 4.55 1.61 1.61 2E.774 2.0 69.0 123.5 86.0 9.52 0.99 0.54 53.4C7 2.0 69.0 123.5 86.0 5.20 0.99 0.59 193.4C7 2.0 70.0 122.5 86.0 5.90 0.13 0.13 113.428 2.0 70.0 122.5 8E.C 5.00 0.13 0.13 113.428 2.0 70.0 122.5 8E.C 5.00 0.01 0.11 1.64.0 133.4C7 2.0 70.0 122.0 8E.C 5.00 0.11 1.61 1.61 1.62.02 2.0 70.0 122.5 8E.C 5.00 0.11 1.62 1.62.02 2.0 70.0 122.5 8E.C 5.00 0.01 0.11 1.64.0 1.11 1.11 1.64.0 1.11 1.64.0 1.11 1.11 1.64.0 1.11 1.11 1.64.0 1.11 1.11 1.11 1.11 1.11 1.11 1.11 1			22°C	71.0	123.0	88.0	3.40	2.85	53.2	0.0		
2.0 71.0 123.0 88.0 4.55 1.61 1.61 26.274 2.0 69.0 123.5 88.0 5.20 0.94 0.54 53.4C7 2.0 10.5 124.0 88.0 5.20 0.94 0.95 103.673 2.0 10.5 122.0 88.0 5.90 0.15 103.673 2.0 70.0 122.5 88.0 5.90 0.11 10.15 103.673 2.0 70.0 122.5 88.0 5.55 0.01 10.11 103.673 2.0 70.0 122.5 88.0 5.55 0.01 0.01 10.32.6 2.0 70.0 122.6 86.0 5.95 0.01 0.01 10.51 10.52.0 2.0 12.0 88.0 5.55 0.05 0.01 10.51 10.52.0 10.50 0.01 10.52 10.52 10.52 10.52 10.52 10.52 10.52 10.52 10.52 10.52 </td <td>2.0 71.0 123.0 88.0 4.55 1.61 1.61 26.274 2.0 69.0 123.5 88.0 5.20 0.94 0.54 53.4C7 2.0 70.5 124.0 88.0 5.20 0.94 0.59 103.4C3 2.0 70.0 122.0 88.0 5.50 0.11 156.202 2.0 70.0 122.0 88.0 5.59 0.11 156.202 2.0 70.0 122.0 88.0 5.59 0.01 156.202 2.0 70.0 122.0 88.0 5.50 0.11 156.202 2.0 70.0 122.0 88.0 5.50 0.11 156.202 2.0 70.0 124.0 88.0 5.50 0.11 156.202 2.0 70.0 124.0 88.0 5.50 0.01 0.11 156.202 2.0 70.0 124.0 88.0 5.56 0.02 0.11 0.11</td> <td></td> <td>7.0</td> <td>22.0</td> <td>0.59</td> <td>122.5</td> <td>96.0</td> <td>4.05</td> <td>2.14</td> <td>2.14</td> <td>15.70</td> <td>8</td> <td></td>	2.0 71.0 123.0 88.0 4.55 1.61 1.61 26.274 2.0 69.0 123.5 88.0 5.20 0.94 0.54 53.4C7 2.0 70.5 124.0 88.0 5.20 0.94 0.59 103.4C3 2.0 70.0 122.0 88.0 5.50 0.11 156.202 2.0 70.0 122.0 88.0 5.59 0.11 156.202 2.0 70.0 122.0 88.0 5.59 0.01 156.202 2.0 70.0 122.0 88.0 5.50 0.11 156.202 2.0 70.0 122.0 88.0 5.50 0.11 156.202 2.0 70.0 124.0 88.0 5.50 0.11 156.202 2.0 70.0 124.0 88.0 5.50 0.01 0.11 156.202 2.0 70.0 124.0 88.0 5.56 0.02 0.11 0.11		7.0	22.0	0.59	122.5	96.0	4.05	2.14	2.14	15.70	8	
2.0 69.0 123.5 88.0 5.2C 0.94 0.54 53.4C7 2.0 70.5 124.0 88.0 5.20 0.39 103.673 2.0 70.0 122.0 88.0 5.70 0.35 0.15 103.673 2.0 70.0 122.0 88.0 5.90 0.11 0.11 155.528 2.0 70.0 124.0 88.0 5.55 6.05 0.09 2.50.0 2.0 71.0 124.0 88.0 5.55 6.05 0.09 2.50.0 2.0 124.0 88.0 5.55 6.05 0.01 1.01 1.01 2.0 124.0 88.0 5.55 6.05 0.01 1.01<	2.0 69.0 123.5 88.0 5.2C 0.94 0.54 53.4C7 2.0 70.5 124.0 88.0 5.20 0.15 103.673 2.0 70.5 122.0 88.0 5.90 0.15 153.528 2.0 70.0 122.5 88.0 5.90 0.11 764.202 2.0 71.0 122.5 88.0 5.55 6.05 0.01 76.00 2.0 71.0 122.5 88.0 5.55 6.05 0.01 76.00 2.0 71.0 124.0 88.0 5.55 6.05 0.01 76.00 2.0 71.0 124.0 88.0 5.55 6.05 0.01 76.00 2.0 72.0 88.0 5.55 6.05 6.01 6.01 76.00 2.0 72.0 88.0 5.55 6.05 6.01 77.1 17.2 17.2 17.2 17.2 17.2 17.2 17.2 17.2		1.0	22.0	71.0	123.0	88.0	4.55	1.61	1.61	26.27	7	
2.0 10.5 124.0 88.C 5.10 0.35 103.673 103.673 2.0 65.0 122.0 88.0 5.90 0.15 153.528 222 2.0 70.0 122.5 88.0 5.90 0.15 153.528 226 2.0 70.0 122.6 88.0 5.95 0.01 3.25.044 226.0 226.04 <td< td=""><td>2.0 10.5 124.0 88.0 5.70 0.35 0.39 103.673 2.1 65.0 122.0 88.0 5.90 0.15 0.15 152.528 2.2 122.0 88.0 5.90 0.15 0.15 152.528 2.0 70.0 122.5 8E.C 5.90 0.15 0.11 166.202 2.1 124.0 88.0 5.59 0.11 0.11 124.0 88.0 5.55 0.09 245.04 2.1 124.0 88.0 5.55 0.00 1.01 126.202 2.2 12.0 124.0 88.0 5.55 0.00 1.01 1.01 1.01 1.01 1.01 1.</td><td></td><td>1.0</td><td>22.0</td><td>0.69</td><td>123.5</td><td>88.0</td><td>5.20</td><td>0.94</td><td>95.0</td><td>53.40</td><td>7</td><td></td></td<>	2.0 10.5 124.0 88.0 5.70 0.35 0.39 103.673 2.1 65.0 122.0 88.0 5.90 0.15 0.15 152.528 2.2 122.0 88.0 5.90 0.15 0.15 152.528 2.0 70.0 122.5 8E.C 5.90 0.15 0.11 166.202 2.1 124.0 88.0 5.59 0.11 0.11 124.0 88.0 5.55 0.09 245.04 2.1 124.0 88.0 5.55 0.00 1.01 126.202 2.2 12.0 124.0 88.0 5.55 0.00 1.01 1.01 1.01 1.01 1.01 1.		1.0	22.0	0.69	123.5	88.0	5.20	0.94	95.0	53.40	7	
2.0 65.0 122.0 6.19 0.15 153.528 2.0 70.0 122.5 86.0 5.50 0.11 10.4 150.4 20.0 2.0 71.0 124.0 88.0 5.55 6.05 0.09 2.50.44 2.0 71.0 124.0 88.0 5.55 6.05 0.09 2.55.044 2.0 71.0 124.0 88.0 6.05 0.01 1.0 1.0 2.0 71.0 124.0 88.0 6.05 0.01 1.0 1.0 1.0 2.0 71.0 124.0 88.0 0.01 1.0 1.	2.0 70.0 122.0 88.0 5.90 0.15 153.628 2.0 70.0 122.5 86.C 5.50 0.11 10.11 10.4.203 2.1 70.0 122.5 86.C 5.50 0.11 10.11 10.4.203 2.2 70.0 124.0 88.0 5.55 0.03 2.50. 10.1 10.4.203 2.1 70.0 124.0 88.0 5.55 0.03 2.50. 10.1 10.1 10.4.203 2.1 70.0 124.0 88.C 6.00 0.01 0.01 10.1 10.1 10.1 10.1 10.1		1.0	22.0	70.5	124.0	98.0	5.70	56.0	0.39	103.67	n	
2.0 70.0 122.5 8E.C 5.50 C.11 0.11 264.203 2.0 71.0 124.0 8B.0 5.55 6.05 0.09 245.044 2.0 77.0 124.0 8B.0 5.55 6.05 0.09 245.044 2.0 70.0 124.0 8B.0 6.00 0.01 0.01 4.8************************************	2.0 70.0 122.5 8E.C 5.50 C.11 0.11 2C4.203 2.0 71.0 124.0 8B.O 5.55 C.CS 0.09 265.044 2.C 7C.O 124.0 8E.C 6.00 0.01 C.C1 ********** F* 1* P*/T* M*T**44		1.0	22.C	0.59	123.0	88.0	5.90	0.15	0.15	153.52	89	
2.0 71.0 124.0 88.0 5.55 6.05 0.09 245.044 2.0 7C.0 124.0 88.0 6.00 0.01 <t< td=""><td>2.0 71.0 124.0 88.0 5.55 6.05 0.09 245.044 2.C 7C.0 124.0 88.C 6.00 0.01 C.C1 ************************************</td><td></td><td>۲٠٥</td><td>22.0</td><td>70.0</td><td>123.5</td><td>86.0</td><td>2.50</td><td>C-11</td><td>0.11</td><td>104-20</td><td>C)</td><td></td></t<>	2.0 71.0 124.0 88.0 5.55 6.05 0.09 245.044 2.C 7C.0 124.0 88.C 6.00 0.01 C.C1 ************************************		۲٠٥	22.0	70.0	123.5	86.0	2.50	C-11	0.11	104-20	C)	
2.C 7.C.O 124.0 88.C 6.00 0.01 C.C1 ************************************	2.C 7C.0 124.0 88.C 6.00 0.01 C.C1 ************************************		1.0	22.0	71.0	124.0	88.0	5.55	50.0	60.0	245.04	4	
F** T** P*/T** H*T***.44 hP bS LF LP LD -356B1 6.5399 0.4236 0.0 3.700 0.0 182.55 73.15 75.11 -553 C.5407 0.2139 0.5074 2.77 0.771 182.65 73.15 75.45 -553 C.5407 0.2146 3.77 1.722 182.63 73.46 75.45 -153 0.537 0.2466 3.77 1.722 182.69 75.46 75.46 -153 0.5399 0.6271 0.5676 3.77 2.251 182.69 75.46 -153 0.5399 0.6281 0.5576 3.77 2.251 182.69 75.46 -153 0.5399 0.6281 0.5566 2.77 2.251 182.69 75.46 -153 0.5399 0.0163 0.5666 2.77 2.251 182.69 75.41 -154 0.5399 0.0163 0.5461 2.77 2.466	F** T** P*/T** H*T***.44 hP bS tF LP LU -2561 C.5399 O.4236 O.C 3.7C0 O.C 182.55 73.15 75.11 -2553 C.5407 O.2139 O.5C74 2.7C1 1.723 182.26 75.45 -2523 C.5399 O.2375 O.2165 3.7C7 1.722 182.63 74.65 -1293 O.5277 O.2466 3.7C7 1.722 182.63 74.46 -1293 O.5283 O.6277 O.5766 3.7C7 1.722 182.63 74.46 -1523 O.5283 O.6281 O.5576 3.7C7 2.251 182.63 74.46 -1524 O.5383 O.0163 O.5566 2.7C2 2.572 114.53 75.24 -1525 O.5399 O.0163 O.5666 2.7C2 2.572 144.50 75.24 -1525 O.5399 O.0163 O.5461 2.7C2 2.466 146.70		1.0	22°C	70.0	124.0	88.0	00*9	0.01	0.01	***	*	
1,55 1,55	LEMYSEC LEPYSEC F17SEC		*	* 4	*	# 1/ # d	55°4*L#M	ď	5.4	5	ځ	3	LP1 MACH
.2581 C.599 O.4236 O.C 3.700 O.C 182.65 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.15 73.46 73.17 73.22 73.23 73.23 73.46 73.46 73.77 1.732 162.39 73.46 73.46 73.77 1.732 162.39 73.46 73.47 73.26 73.46 73.46 73.46 73.46 73.46 73.46 73.46 73.46 73.46 73.46 73.46 <th< td=""><td>-3581 C.5399 0.4236 0.C 3.700 0.C 182.55 73.15 75.11 .553 C.5407 0.2139 0.5024 3.707 C.771 185.28 55.12 75.65 .5232 C.5399 0.2375 0.2316 3.707 1.722 162.28 55.12 75.46 .1293 0.5391 0.13.7 0.4546 3.707 1.722 162.28 104.56 75.46 .0542 0.5391 0.013.7 0.5566 3.707 2.251 182.23 112.63 75.41 .0544 0.5399 0.0637 0.5566 3.707 2.251 182.03 114.70 75.24 .0544 0.5391 0.0134 0.6461 3.707 2.251 182.04 114.70 75.24 .0556 0.5391 0.0134 0.6461 3.707 2.466 182.01 114.70 75.24 .0144 0.5391 0.0134 0.6461 3.707 3.466 14.670 14.27</td><td></td><td></td><td></td><td></td><td></td><td></td><td>L BM/SEC</td><td>LBMISEC</td><td>F1/5EC</td><td>FT/SEC</td><td>FT/SEC</td><td></td></th<>	-3581 C.5399 0.4236 0.C 3.700 0.C 182.55 73.15 75.11 .553 C.5407 0.2139 0.5024 3.707 C.771 185.28 55.12 75.65 .5232 C.5399 0.2375 0.2316 3.707 1.722 162.28 55.12 75.46 .1293 0.5391 0.13.7 0.4546 3.707 1.722 162.28 104.56 75.46 .0542 0.5391 0.013.7 0.5566 3.707 2.251 182.23 112.63 75.41 .0544 0.5399 0.0637 0.5566 3.707 2.251 182.03 114.70 75.24 .0544 0.5391 0.0134 0.6461 3.707 2.251 182.04 114.70 75.24 .0556 0.5391 0.0134 0.6461 3.707 2.466 182.01 114.70 75.24 .0144 0.5391 0.0134 0.6461 3.707 3.466 14.670 14.27							L BM/SEC	LBMISEC	F1/5EC	FT/SEC	FT/SEC	
553 C.5407 0.2139 0.62624 2.7C7 C.771 182.EB E7.21 75.45 532 C.5359 0.2375 0.2165 3.7C2 1.203 182.28 55.12 75.46 1293 0.5391 0.0137 0.6454 3.7C3 1.722 182.29 104.56 75.46 264 0.5393 0.0577 0.5566 2.7C1 2.172 182.03 114.72 75.46 264 0.5399 0.0163 0.5566 2.7C2 2.272 182.01 114.72 75.26 264 0.5391 0.0163 0.5566 2.7C2 2.466 182.01 114.72 75.26 275 0.5383 0.0134 0.6461 2.7C2 2.466 182.01 114.70 75.24 276 0.5383 0.0134 0.6461 2.7C2 2.466 182.01 116.70 75.22 276 0.50 0.50 0.75 2.466 182.01 116.70 75.22<	.259 C.5407 0.2139 0.6274 2.707 C.771 182.61 E7.21 75.65 .253 C.5359 0.2375 0.2165 3.700 1.203 182.28 95.12 75.46 .1293 0.5391 0.13.7 0.4546 3.707 1.732 162.53 112.53 75.46 .0542 0.5393 0.0577 0.5765 3.707 2.251 182.03 112.53 75.41 .0544 0.5399 0.0034 0.5906 3.702 2.251 182.05 114.33 75.26 .0155 0.5391 0.0163 0.5566 3.702 2.251 182.05 114.33 75.26 .0155 0.5983 0.0134 0.6461 2.702 2.466 182.01 118.27 75.26 .0156 0.5983 0.0134 0.6461 2.702 2.466 182.01 118.27 75.22 .0157 0.506 0.750 3.702 3.446 3.702 3.446 3.702		0.	C.2581	6665.3	0.4236	0.0	3.700		182,55	73.15	75.11	490.0
.5232 C.5359 0.2315 0.2165 3.7CC 1.203 182.28 55.15 75.46 .1293 0.5391 0.13.7 0.4546 3.7C3 1.722 162.59 104.56 75.56 .0542 0.5392 0.0577 0.5505 3.7C1 2.172 182.53 112.53 75.41 .0544 0.5399 0.0577 0.5506 3.7C1 2.172 182.03 112.53 75.41 .0554 0.5399 0.0163 0.5566 3.7C2 2.251 182.05 114.30 75.24 .0155 0.0596 3.7C2 2.251 182.05 118.27 75.25 .0144 0.06461 3.7C2 2.251 182.04 118.27 75.25 .0144 0.0134 0.06461 3.7C2 2.466 182.01 118.27 75.25 .0144 0.0035 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003 0.003	1293 C.5339 O.2375 O.23165 3.7CC 1.203 182.28 55.12 75.46 .1293 O.5391 O.13 7 O.4546 3.7C7 1.722 162.59 104.56 75.56 .0542 O.5383 O.6577 O.5905 3.7C7 2.251 182.63 112.53 75.41 .0564 O.5399 C.6281 O.5966 3.7C7 2.251 182.63 114.32 75.36 .0564 O.5399 C.6281 O.5966 3.7C2 2.466 182.01 114.32 75.36 .0565 O.5393 O.0134 O.6461 3.7C2 2.466 182.01 118.37 75.32 .0514 C.5383 C.6015 ********** 3.7C2 ******** 182.15 ******** 75.32 .0504 C.510 O.850 O.75C ******** 182.15 ******* 75.32 ******** I.030 C.510 O.850 O.75C ******* 15.32 *		.2080	0.2553	C . 5 4 0 7	0.2139	0.2624	3.107		182.61	15.73	75.65	0.064
-1293 0.5391 0.13·7 0.4546 3.7C1 1.732 1e2.5e 104.56 75.56 .0542 0.5383 0.6577 0.5765 3.7C1 2.172 182.63 112.53 75.41 .0564 0.5384 0.6576 3.7C1 2.251 182.03 114.33 75.36 .0564 0.5396 3.7C1 2.251 182.05 114.33 75.36 .0153 0.0163 0.5566 2.7C2 2.466 182.01 114.70 75.36 .0154 0.0163 0.5566 2.7C2 2.466 182.01 116.70 75.36 .0155 0.5383 0.0134 0.6461 2.7C2 ******** 182.15 ******* 75.36 .0155 0.50 0.51 0.056 0.750 0.750 ******* 75.36 .025 0.50 0.55 0.104 ******* 1.50 ****** 75.36 ******** 0.143 0.126 0.104 ******* <	-1293 0.5391 0.13 7 0.454¢ 3.777 1.732 162.59 104.5¢ 75.5¢ -5542 0.5283 0.6577 0.5765 2.701 2.172 182.03 112.53 75.41 -6264 0.5399 0.6281 0.5905 3.777 2.251 182.05 114.32 75.3¢ -6153 0.5391 0.0163 0.556¢ 2.772 2.251 182.05 114.32 75.3¢ -6153 0.5391 0.0163 0.556¢ 2.772 2.251 182.05 114.30 75.3¢ -6155 0.5391 0.0163 0.556¢ 2.772 2.251 182.05 114.70 75.3¢ -6155 0.5393 0.0134 0.6461 2.772 2.466 182.01 118.27 75.32 -6014 0.5383 0.0134 0.6461 2.702 ******* 182.15 ****** 75.22 -6015 0.50 0.75 1.00 1.25 1.50	٠	.3253	0.2232	65859	0.2375	0.2165	3.760	1.203	182,38	21.22	75.46	0.064
0542 0.5283 0.0577 0.5765 2.7C1 2.172 182.53 112.53 75.410264 0.5399 0.0281 0.5905 3.7C7 2.251 182.05 114.32 75.260153 0.5391 0.0163 0.556E 2.7C2 2.251 182.05 114.32 75.260155 0.5393 0.0134 0.64E1 2.7C2 2.466 182.01 118.77 75.340125 0.5393 0.0134 0.64E1 2.7C2 2.466 182.01 118.77 75.320125 0.5393 0.0134 0.64E1 2.7C2 2.466 182.01 118.77 75.320125 0.501 0.0134 0.0134 0.125 1.5C	05542 0.5283 0.0577 0.5765 2.701 2.172 182.53 112.53 75.410264 0.5399 0.0281 0.5905 3.707 2.251 182.05 114.33 75.360153 0.5991 0.0163 0.556E 2.702 2.251 182.05 114.33 75.360155 0.5991 0.0163 0.556E 2.702 2.2572 182.04 114.70 75.340125 0.5993 0.0134 0.64E1 2.702 2.466 182.01 118.77 75.320126 0.5383 0.0134 0.64E1 2.702 2.466 182.01 118.77 75.320126 0.5903 0.0134 0.0135 0.105 2.466 182.01 118.77 75.320127 0.5903 0.0134 0.125 1.50		6194	0.1293	0.5391	0.13 '7	0.4546	3.767		162.58	104.56	75.56	0.064
	C153 0.5399	F3	.5867	0.0542	0.5283	1753.0	0.5765	3.761		162.23	112.53	15.41	590°C
.C153 0.5391 0.0163 0.556E 2.7C2 2.5672 182.C4 114.70 75.34 .C125 0.5383 0.0134 0.64E1 2.7CC 2.466 182.01 118.27 75.22 .CC14 C.5383 C.CO15 ******* 2.7C2 ******* 182.15 ****** 75.22 .CC14 C.5383 C.CO15 ******* 2.7C2 ******* 182.15 ****** 75.22 .CC14 C.5383 C.CO15 ******* 2.7C2 ******* 182.15 ****** 75.22 .CC14 C.5383 C.CO15 ******* 2.7C2 ******* 182.15 ****** 75.22 .CC14 C.5383 C.CO15 ******* 0.75C ******* 182.15 ******* 75.22 .CC15 O.50 C.75 1.CC 1.25 1.5C .***********************************	.C153 0.5391 0.0163 0.556£ i.7C2 2.572 182.C4 114.70 75.34 .C125 0.5383 0.0134 0.64£1 3.7CC 2.466 182.01 118.27 75.32 .CC14 C.5383 C.CO15 ******* 2.7C2 ****** 182.15 ****** 75.32 .CC14 C.5383 C.CO15 ******* 2.7C2 ****** 182.15 ****** 75.32 .CC14 C.5383 C.CO15 ******* 2.7C2 ****** 182.15 ****** 75.32 .CC14 C.5383 C.CO15 ******* 2.7C2 ******* 182.15 ****** 75.32 .CC14 C.5383 C.CO15 ****** 2.7C2 ****** 182.15 ****** 75.32 .CC15 O.50 C.75 1.CC 1.25 1.5C .***********************************		. 6672	0.6264	6665.0	C. C281	5065.0	3.767		182.05	114.33	75.36	0.064
.C125 0.53A3 0.0134 0.64E1 3.7CC 2.466 182.01 118.27 75.22 .CC14 C.53E3 C.CO15 ******** 3.7C2 ******* 182.15 ****** 75.22 .CC14 C.53E3 C.CO15 ************************************	.C125 0.53#3 0.0134 0.64£1 3.7C 2.466 182.01 118.27 75.22 .CG14 C.53&3 C.CO15 ******** 3.7C2 ******* 182.15 ****** 75.22 .CG14 C.53&3 C.CO15 ************************************		.6135	0.0153	0.5391	0.0163	0.556	£ .7C3		182.04	114.70	15.34	0.064
**CC14	**CC14	u	.6665	0.0125	0.53A3	0.0134	0.6481	3,700		182.01	118.27	15.32	6.064
E [1STR]BUJICh FCR HUN: 9 POSITION A 0.25 0.50 C.75 1.CC 1.25 ****** 1.030 C.510 0.850 0.75C ****** 0.143 0.126, 0.115 0.104 E CISTR]BUJION FCR RUN: 9 PGS]TION B 0.25 0.50 C.75 1.00 1.25 1 1.120 0.540 0.820 ***** 0.790 C.156 0.131 0.114 ****** 0.110	E [1STR]BUJICh FCR HUN: 9 POSITION A 0.25 0.50 C.75 1.CC 1.25 1***** 1.030 C.510 0.850 0.75C ****** 0.143 0.126, 0.115 0.104 ** E CISTR]BUJION FCR RUN: 9 PGS]TION B 0.25 0.50 C.75 1.00 1.25 1 1.120 0.540 0.820 ***** 0.790 C.156 0.131 0.114 ****** 0.110	-	* * * * * * * * * * * * * * * * * * * *	0.0014	C•5383	c.co15	****	3.703		182.15	***	15.38	0.064
0.25 0.50 C.75 1.CC 1.25 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0.25 0.50 0.75 1.CC 1.25 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-	CK FPESS	LRE CISTR	BUT ICH FC			4					
****** 1.030 C.510 0.830 0.75C ** ****** 0.143 0.126, 0.115 0.104 ** E CISTRIBUTION FCR RUN: 9 PGSJT10A B 0.25 0.50 C.75 1.00 1.25 1 1.120 0.940 0.820 ****** 0.790 C.156 0.131 0.114 ****** 0.110	****** 1.030 C.510 0.830 0.75C ** ****** 0.143 0.126, 0.115 0.104 ** E CISTRIBUTION FCR RUN: 9 PGS1710A B 0.25 0.50 C.75 1.00 1.25 1 1.120 0.940 0.850 ****** 0.790 C.156 0.131 0.114 ****** 0.110 BOX OPEN		0.0	62.0	0.50	6.75	1.00		1.50				
###### 0.143 0.126, 0.115 0.104 # E CISTRIBUTION FCR RUN: 9 PGSITION B 0.25 0.50 C.75 1.00 1.25 1 1.120 0.940 0.820 ****** 0.790 C.156 0.131 0.114 ****** 0.110	##### 0.143 0.126, 0.115 0.104 # E CISTRIBUTION FCR RUA: 9 PGS1710A B 0.25 0.50 C.75 1.00 1.25 1 1.120 0.940 0.820 ****** 0.790 C.156 0.131 0.114 ****** 0.110 BOX OPEN		* * * * *	* * * * * * * *	1.030	0.510	0.830		****				
E CISTRIBUTION FCR RUN: 9 PGSITION B 0.25 0.50 C.75 1.00 1.25 1 1.120 0.940 0.820 ****** 0.790 C.156 0.131 0.114 ****** 0.110	E CISTRIBUTION FCR RUN: 9 PGSITION B 0.25 0.50 C.75 1.00 1.25 1 1.120 0.940 0.820 ****** 0.790 C.156 0.131 0.114 ****** 0.110 BOX OPEN		****	****	0.143	0.126.	0.115		***				
0.25 0.50 C.75 1.00 1.25 1 ** 1.120 0.940 0.820 ***** 0.790 ** C.156 0.131 0.114 ***** 0.110	0.25 0.50 C.75 1.00 1.25 1 1.120 0.940 0.820 ****** 0.790 C.156 0.131 0.114 ****** 0.110 BOX OPEN		CK PRESSI	LRE CISTR !	18UT ICN FC			8					
1.120 0.940 0.820 ***** 0.790 C.156 0.131 0.114 ***** 0.110	1.120 0.940 0.820 ***** 0.790 C.156 0.131 0.114 ***** 0.110 BOX OPEN		0.0	92.0	0.50	C.75			1.50				
C.156 0.131 0.114 ***** 0.110	C.156 0.131 0.114 ***** 0.110 BOX OPEN		****	1.120	0.940	0.820	* * * * *	0.790	0.650				
			* * * *	C.156	0.131	0.114	* * * * * *	0.110	0.050				

TABLE XI (CONTINUED)



CATA TAKEN CN 22 AUGUST 157E BY LERKE AND STAEHLI S/C=.5; FCFTEC STACK WITH 2 RING OIFFUSOR AND SHROUD.SECCNCARY BOX OFEN

N.P.	ALAEER CF FRIMAFY ACZZLES Pfimary aozzle giapeter:	AFY NC22 GIAPETE	CZZLES: 4 ETEP: 3.70 INCPES	. ,			LPTAKE CIAMETEF: 11,50 INCPES AREA RATIC, AW/AF: 2,50	ETEF: 11.	.50 INCHES 2.50		
PIXING	PIXING STACK LENGTH		: 29.25 INCHES ER: 11.70 INCHES				ORIFICE OIAMETER: CRIFICE BETA: C.457	_	6.5C2 INCHES		
F131AG	ING STACK L/C:	70: 2.50	26				AMEIENT PRESSURE:		29.58 INCHES HG	IJ	
z	PCR	0 F C F	TCR	TUPT	TAPE	₽U~DA	P.A.P.S	PA-FT	SECCNOARY AREA	·	TERTIAFY AREA
5	INCHES	OF WATER		DEGREES FAHRENHEIT	NHEIT	INC	INCHES CF NATER	Œ	SCUAFE INCHES		SQUARE INCHES
_	0.7	35.6	71.5	125.0	98.0	00.9	0.0	0.55	*****		0.0
7	0.7	22 °C	71.0	125.0	96.0	9.00	. 0.0	0.47	****		3.142
e,	1.0	0.55	72.0	125.5	£ £ . C	5.55	0.0	0.40	*****		6.283
•	0.7	22°C	76.0	125.0	98.0	00.9	J. J	92.0	*****		12.566
47	1.0	22.0	73.0	125.0	98.0	6.C0	0.0	0.20	*****		18.850
Ŷ	C-3	22.0	65.5	125.0	86.0	00.9	0.0	0.14	***		25.133
~	0.7	22.0	71.5	124.0	98.0	6.00	0.0	0.C8	****		37.659
80	0.7	22.0	0.59	123.5	96.0	33.3	٠° ت	90.0	****		50.265
٧	0.7	22.0	71.5	123.5	88.0	6.00	J•.J	0.0	*****	*	***
SECCNEARY	CARY 80X										
z	*	*	*	*1/*d	74. **T*H	ď	S.	d D	¥0	3	UPT MACH
RCA						1.8M/SEC	L EM/S EC	FT/SEC	FT/SEC	FT/SEC	
-	****	0.0	C-5367	0.0	*****	3.658	*****	18 2 . 20	****	75.40	0.064
2	****	0.0	1925.0	0.0	*****	3,766	****	182.29	* * * * * * *	75.44	0.064
ы	****	0.0	(*5359	0.0	* * * * * * *	3.656	***	182.27	****	75.43	0.064
4	****	0.0	0.5367	0.0	*****	3.7(3	*****	182.46	***	75.51	0.064
2	****	0.0	0.5367	0.0	*****	3.652	*****	181.54	****	75.30	0.064
9	****	0.0	1963.0	0.0	****	2.765	*****	162.55	****	75.54	990.0
7	****	0.0	0.53 63	0.0	****	3.658	*****	181.89	***	75.27	790.0
æ	***	3	C. 5391	0.0	****	3.707	*****	182.16	****	75.25	C.C64
پ	***	0.0	C.5391	0.0	*****	3.458	***	181.73	* * * * * * *	15.21	0.064
(၁)	SECONDARY	IDARY	BOX OPEN	(TERT	(TERTIARY PUMPING)	MP ING)					
				•							

TABLE XI (CONTINUED)



4		*	FT*	1	PT*/TT*	hT#1]**.44 hP	44 41	7	Š	UĒ
RUN							LBM/SEC	LEY/SEC	FT/SEC	FT/SEC
1		0.0	9920.0	1965.0	0.0816	0.0	3.656		****	50.55
2		6.0155	0.0652	1983.0	0.0656	0.015	3.700	C . C 7	***	51.97
m)		C.0361	0.0555	Q.5359	0.0553	0.035	3.656	C • 13	***	52.81
4	_	0.0580	0.0360	79:53 D:	0.0364	6.056	3.763	C.21	***	52.59
u۱		3210.3	0.0272	0.5367	0.0250	510.0	3.653	0.28	****	54.73
9		C.CE51	0.0194	1965.0	0.0207	0.CE3	3.765	C • 3 5	***	55.25
7		1950-0	0.0112	0.5383	0.0119	6.054	3,9€	0.36	***	55.78
w		C.1114	0.((83	1665.0	0.0089	0.166	3.767		***	56.62
5	-	*****	0.0	1565.0	0.0	***	3.458	****	***	50.82
7	XING ST	ACK PRESS	LRE CISTR	PIXING STACK PRESSURE CISTRIBUTION FOR RUN:	R RUN:	9 POS1110N A	۷ -			
	3/C:	0.0	(*55	X.50	0.75	1.00	1.25	1.50		
FPS(11A. F2C):	1261:	****	***	1.030	C.520	0.830	0.770	****		
	FP S# :	***	***	0.144	0.128	0.116	0.168	****		
-	XING ST.	ACK PRESS	LRE CISTR	PIXING STACK PRESSURE CISTRIBUTION FOR RUN:		9 POSITION B	8			
	x/C:	0.0	97.0	05.0	0.75	1.00	1.25	1.50		
FPS(11A. F2C):	1561:	****	1.140	0.530	0.830	***	0.810	0.650		
	F P. S. # 2	***	C. 159	0.130	0.116	****	0.113	0.051		

TEF11481 ECX

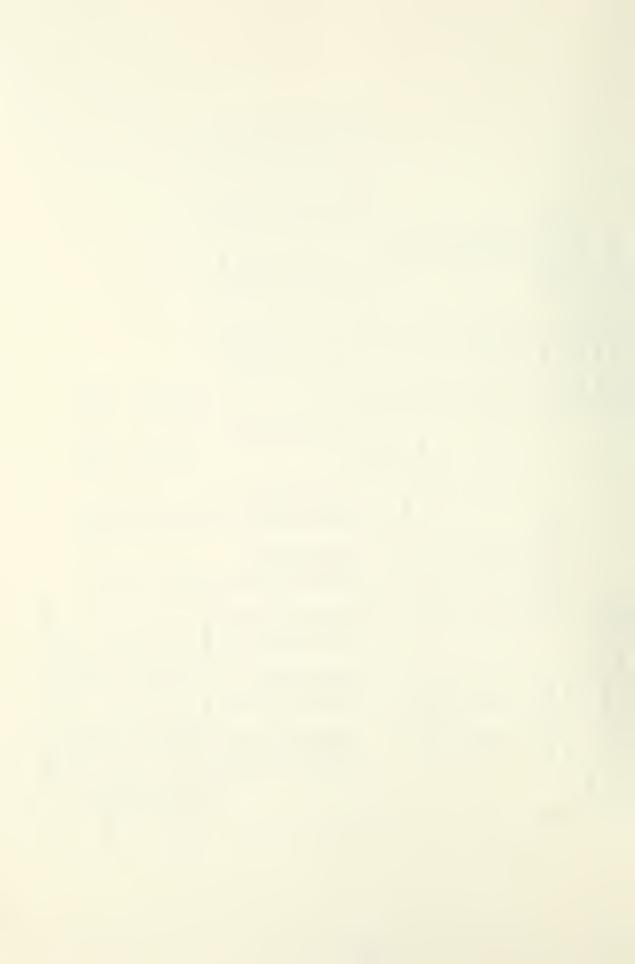
TABLE XI (c) CONTINUED)



																UFT PACH		0.064	0.064	990.0	990.0	990.0	0.064	0.064	0.064	0.064								
				FG	BREA	hES.		9	C)	u\	1	•	2	5	•	1	F1/5EC	75.86	75.69	75.74	75.55	15.51	75.63	75.48	75.42	75.45								
50 INCHES	2.50	6.502 INCHES		29.98 INCHES PG	SECCACARY AREA	SCLAFE INCHES	0.0	12.566	25.13	£C.265	100.531	150.796	201.062	545.044	***	î	F1/SEC	72.28	84.45	15.56	101.55	125.44	119.73	122.70	125.40	****								
ETEF: 11.	AP/AF:		A: 0.497		FA-FNZ	Œ.	2.63	20.5	1.62	0.84	0.71	0.25	0.16	0.12	o • c	٦	FT/SEC	183.30	183.28	183.01	182.66	182.60	182.74	162 .39	162.23	162.32								
LPTAKE CLAMETEF: 11.50 INCHES	AREA RATIC, AF/AF:	ORIFICE OIAPETEF:	CRIFICE BETA: 0.497	AMEIENT PRESSURE:	PA-PS	INCHES OF WATER	2.63	5.05	1.62	0.64	C.71	C. 25	0.16	0.12	J*3	٠, ه	L EM/SEC	J•J	0.604	1.073	1.545	2.641	5.529	2.658	2.847	****		1.50	****	****		1.50	0.660	0:054
_	•		_		PU-PA	INC	3.60	4.10	4.50	5.10	5.60	5. 80	35.5	00.9	00.9	J.	181/SEC	3,4,6	3.763	3.700	3.700	3.7€0	3.767	3.767	3.710	3.767	⋖ -	1.25 1.	0.870 **	0.121 **	00	1.25 1.	0.880	
					TAME	HEIT	98.0	3.88	88.0	98.0	8 E . C	88.0	98.0	98.0	88.0	h+T++.44		0.0	0.1584	0.2618	5507-0	0.7463	0.6636	0.7077	0.7468	*****	A NOILISON 9	1.00	1.010	0.140	9 POSITICN 8	1.00	*****	*****
	ES				TUPT	CEGREES FA-RENHEIT	125.0	125.0	125.0	125.0	125.0	125.0	124.0	123.0	124.0	*1/*d		0.3854	C.3001	0.2381	0.1239	C.1048	0.0369	0.0236	0.0177	0.0		27.0	1.120	0.155		0.75	1.020	0.142
7	IAMETER: 3.70 INCHES	INCHES	STACK OIAMETER: 11.70 INCHES		1CR	CEGA	72.0	70.0	71.0	71.0	71.0	0.59	0.59	66.0	0.59	*		C.5367	1965.0	1955.0	1965.0	0.5367	1965.0	C • 5383	0.5399	C. 5383	UPE CISTRIEUTION FOR RUN:	05.0	1.260	0.175	PIXING STACK PRESSURE DISTRIBUTION FOR RUN:	0.50	1.220	0.169
NC22LES:	IAPE TER:	PIXING STACH LENGTH; 29.25 INCHES	PETER: 11.	2.50	CPOR	WATER	22.0	22.0	0.55	22.0	22.0	0.55	22.0	22.0	22°C	*		0.3610	0.2811	0.2230	0.1161	0.0982	(•(345	0.0222	C.C167	J•C	UPE CISTR	6.25	****	****	LRE BISTRI	6.25	1.560	(.716
NUPEER OF FRIPAF	FFIFFRY NOZZLE C	STACK LEN	STACK OIA	MIXING STACK L/D:	FCF	INCHES OF	0.7	0.7	C. 7	7.0	0.7	1.0	C.7	0.7	C • 7	*		0.0	C.1630	0.2560	C.4177	0.7680	C•6823	0.7278	0.7675	*****	PIXING STACK PRESSI	0.0	* * * *	* * * * * * * * * * * * * * * * * * * *	ACK PRESS	0.0	****	* * * * * * * * * * * * * * * * * * * *
NUMEER	FFILLRRY	FIXING	FIXING	MIXING		_											4			_							IXING ST	x/[:	FMS(IN. 12C):	F 5 4 5	IXING ST	3/C:	PPS(IN. HZC):	PHS#1
					~	FLA	1	2	C)	4	S	9	7	9	5	4	RUR	1	2	m	4	2	ę	7	8	6	•		FPSC IN		1		N I) 5 d d	

(d) TOTAL PERFORMANCE

TABLE XI (CONTINUED)



												UPT M 1CH		0.064	0.064	0.064	990.0	9.064	990.0	0.064	0.064	0.064
9 1	AREA	HES		¥	91	2		9	2	4	*	n	FT/SEC	75.11	75.CC	74.88	74.74	74.65	74.57	74.55	74.54	74.53
UPTAKE CIAPETEF: 11.50 INCFES AREA RATIC, AM/AP: 2.5C CRIFICE DIAPETEF: 6.9C2 INCFES CRIFICE BETA: C.457 AMBIENT PRESSURE: 25.51 INCHES HG	SECCNCIRY AREA	SCUARE INCHES	0.0	12.566	25.133	50.265	100.521	150,756	201.062	245.044	****	Σ	F1/5EC	72.56	84.62	53.44	105.25	115.23	116.60	120.76	122.37	***
UPTAKE CIAPETEF: 11.50 INCFES AREA RATIC, AM/AP: 2.5C CRIFICE DIAPETEF: 6.9G2 INCF CRIFICE BETA: C.457 AMBIENI PRESSURE: 25.51 INCH	FA-FN2	G. D.	3.25	2.55	1.52	1.18	0.50	C-24	0.16	0.12	0.02	4.0	FT/SEC	161.50	181.23	186.53	180.60	180.47	180.18	186.14	180.12	180.08
UPTAKE CIAMETEF: 11 AREA RATIC, AMJAP: CRIFICE DIAMETEF: CRIFICE BETA: C.457 AMBIENT PRESSURE:	PA-PS	INCPES OF WATER	3.25	2.55	1.92	1.18	0.50	92.0	0.16	0.12	20.0	SH	L EM/SEC	J.,	0.688	1.153	1.871	2.436	2.531	2.756	2.647	* * * * * *
	PL-PA	INC	3.00	3.65	4.20	4.55	5.69	5.80	5.85	2 .90	99.9	E E	LBM/SEC	3.750	3 .752	3.745	3.745	3.752	3.745	3.749	3.749	3.745
	TAFE	NEIT	J• 59	0.49	9.49	9.49	9.49	9.49	9.43	0. 49	9.49	64T***44		0.0	0.1768	0.3070	0.4813	0.6260	0.6512	0.7665	C. 7325	***
۷) س	TUPT	CEGREES FAFRENHEIT	106.5	108.5	109.0	105.0	109.0	109.0	109.0	109.0	109.0	#1/#d		0.4877	0.3723	0.2815	0.17.56	0.0737	0.0355	0.0237	0.0170	0.0030
Y NCZZLES! 4 IAPETEF: 3.7C INCFES CTF: 29.25 INCHES PETER: 11.7C INCHES : 2.50	TCR	CEGR	55.5	0.11	26.0	26.0	55.0	56.0	54.0	26.0	56.0	*		0.5217	0.5217	(*5509	0.5209	0.5209	0.9209	0.5209	C. \$209	0.9209
FY ACZZLES CIAMETER: ACTM: 29.2 AMETER: 11	СЕСЯ	CF WATER	22.0	22.0	22.0	22.0	22.0	22.0	22 · C	22.0	22.0	# d		0.4455	2675.0	0.2592	0.1599	0.0679	0.0327	0.0218	0.0157	0.0027
NLPEER CF FRIPAET NCZZLES: 4 PRIPARY NOZZLE CIAPETEF: 3.7C IN PIXING STACK LENGTP: 29.25 INCHES PIXING STACK CIAPETER: 11.7C INCH	FCB	IACHES C	C-3	0.7	0.7	0.7	0.1	7.0	0.7	0.7	1.0	* 3		0.0	C-1832	0.3183	C.4591	0.6451	(.6752	0.7351	6.1555	* * * * * * * * * * * * * * * * * * * *
7 F 1 F 1 F 1 F 1 F 1 F 1 F 1 F 1 F 1 F	4	ILN ILN	1	2	Πì	4	5	9	7	8	5	z	PUN	1	2	en.	4	2	ę	1	æ	σ

PERFORMANCE DATA FOR THE PORTED STACK WITH TWO-RING DIFFUSOR AND SHROUD CUT BACK ONE-HALF INCH FROM MIXING STACK ENTRANCE TABLE XII.

TERTIARY BOX CLOSED

(a)



												UPT MACH		0.064	0.064	0.064	0.064	2.064	990.0	990.0	490.0	790.0
9	A 75	ų,		41	•	ю		۰.		æ		20	F1/SEC	14.55	14.78	74.61	14.58	14.40	74.44	14.46	14.45	74.50
.5G INCHES 2.50 6.902 INCHES	SECCNEDRY AREA	SQUARE INCHES	0.0	12.566	25.133	50.265	100.521	150.796	201.05	245.044	***	N.	F1/5EC	72.45	83.54	51.85	102.20	110.11	113.55	116.91	115.11	***
16168: 11. AM/AP: METER: 6 14: C-457			3. es	2.18	1.67	26.0	C.35	C.21	91.0	0.10	0.01	ÜF	F1/SEC	181.20	180.65	186.28	180.22	27.271	175.87	175.52	175.50	180.02
UPTAKE CIAMETER: 11.5G INCHES AREA FATIC, AN/AP: 2.50 CRIFICE DIDMETER: 6.902 INCH- CRIFICE BETA: C.457	FA-FS FA-FN	INCHES OF WATER	3.89	2.1€	1.67	75.3	0.35	0.21	0.14	0.10	10.0	S	LBM/SEC	0.0	££9.0	1.108	1.688	2.141	2.357	2.515	2.642	***
	PU-FA	INC	3.40	4.00	4.50	5.20	5.65	5.60	2.90	5.55	00.9	ď	LBM/SEC	3.756	3.756	3.754	3.756	3.752	3.752	2.754	3.754	3.754
	1 A P &	FEIT	3.59	0.69	3.59	0.59)*59	0.69	0.59	3.53	J*59	55。44【41		J.0	0.1634	0.2842	0.4255	0.5524	0.6085	9.6506	0.6624	****
υ, ພ	TUPT	DEGREES FAFRENFELT	106.0	106.5	106.5	107.0	107.0	107.5	107.5	107.5	108.0	P # / T #		0. 5656	0.3191	0.2455	0.1428	0.0577	C.C311	C.0200	0.0148	C.C015
4 2.70 INCHES 5 INCHES -70 INCHES	TCR	DEGR	54.0	53.5	54.5	54.0	55.0	55.0	54.5	54.5	54.5	*		0.5346	0.9338	0.5338	0.5329	C • 9329	0.5321	0.5321	0.9321	0.5313
NC 22LES AMETER: TH: 29.2 ETER: 11	2		22.0	22.0	22.0	22.C	22.C	22.C	22.0	22.0	22.C	±		93250	C.2575	0.2253	0.1333	0.0538	0.623.0	0.0186	0.0138	0.0014
NLPBER OF FFIPARY NC22LES: 4 FFIPAR'N NG22LE CIAMETER: 2.7C INCH MIXING STACK LENGTH: 39.25 INCHES MIXING STACK OILPETER: II.7O INCHES	40a	INCHES CF	0.7	٥.٦	6.0	0.7	1.0	0.7	0.7	7.0	V. 0	*		0-0	C. 1684	C.2950	6.4455	C. 5706	C.6280	0.6710	(.,7035	*****
PEIPA FIIPA FIXIN	z	RLA	-	í,	3	4	5	9	7	89	\$	z	RLN	1	2	۳	4	w,	ţ	7	8	٥

TABLE XII (CONTINUED)

TERTIARY BOX OPEN

(q)



CATA TAKEN ON 25 AUGUST BY LEMKE ANC STAEFLI S/C=.5; SFFCUCEC FCRTEC STACK ANC TWO SOL IO DIFFUSOR RINGS, TERT. BOX CCNTROLLEC

NCF	NLPEER CF FRIMAFY PRIMARY ACZZLE DI	NEY NCZZLESI DIAMETER:	NC 22LES: 4 APETER: 3.70 INCHES	ES			LPTAKE CIAMETEF: 11.50 INCPES AREA RATIC, AP/AF: 2.50	PETEF: 11.	50 INCHES 2.50	
XIA	PIXING STACK LENGTF: 29.25 INCFES PIXING STACK CIAPETEF: 11.70 INCHES	:NET	S INCHES				DRIFICE OIAMETER: CLIFICE BETA: C.457	~	6.902 INCHES	
13	PINING STACK L/C:	05*2 :3/					AMBIENT PRESSURE:	ESSURE: 2	25.51 INCHES HG	
4	FCR	CFCF	TCR	TUPT	TAME	PU-FA	PA-PS	PA-FT	SECCNCAFY ARE	TERTIARY AREA
FL	INCHES CF	F WATER	DEGR	DEGREES FAHRENHEIT	NFEIT	INC	INCHES OF WATER	E .	SCLAPE INCHES	SQUARE INCHES
-	۲•٥	3.55	55.0	105.0	73.C	93.9	0.0	93.0	***	0.0
7	1.0	22.0	55.0	109.0	73.6	9.00	0.0	0.45	****	3.142
m	0.7	22.0	56.0	105.0	73.0	6.00	0.0	0.28	****	6.283
4	6.0	22.0	55.5	105.0	73.57	03.9	0.0	73.0	****	12.566
2	1.0	22.0	5.5	105.0	73.C	6.00	o•0	0.21	****	18.850
ę	6.7	22°C	5.5	105.0	73.0	00.9	0.0	0.15	***	25.133
7	1.0	22.0	54.0	105.0	73.0	99.9	٥٠٠	53.3	****	37.699
œ	1.0	22.0	55.0	105.0	73.6	00.9	0.0	0.07	*****	50.265
۰	0.7	22.0	55.0	105.0	73.0	00.9	0.0	0.01	****	***
SECCA	SECCACAFY BCX									
~	*	ī	*	P#/T*	h*T**.44	F	VI I	LF	ر د ۲	LU LPT MACH
ALA						LBY/SEC	LEP/SEC	F1/5EC	FT/SEC FT	FT/SEC
	****	0.0	1965.0	0.0	*****	3.752	*****	186.25	52 *****	14.55 0.064
2	****	0.0	1985.0	0.0	*****	3.752	****	160.25	72 *****	74.55 0.064
n,	***	0.0	1963.0	0.0	*****	3.7.5	****	IEC.C7	7C *****	74.52 0.064
4	****	0.0	1985.0	0.0	*****	3.750	****	186.16	72 *****	74.56 0.064
5	***	٥•ر	C. \$367	0.0	*****	3.751	****	180.16	72 *****	74.56 0.064
¥	***	٥٠٠	1965-0	0.0	*****	2.751	*****	180.16	72 ****	74.56 0.064
7	***	J•0	0.5367	0.0	******	3.756	****	186.42	52 *****	14.67 0.064
	****	0.0	1965.0	0.0	****	3.752	****	180.25	72 *****	74.55 0.064
5	****	J•0	1965.0	0.0	******	3.752	****	186.25	5L #####	74.59 0.064
(c)	TERTIARY	RY BOX	CONTROLLED	LLED						

TABLE XII (CONTINUED)



UE	F1/SEC	50.40	51.37	52.12	52.36	54.35	54.82	59.65	56.25	****								
Š	F1/SEC	****	***	****	* * * * *	***	***	****	***	****								
F 1	LBM/SEC	0.0	0.07	0.13	C.22	62.0	E 2 • 0	0.38	0.44	***		1.50	***	****		1.50	0.620	0.086
7.4	LEM/SEC	3.752	3.752	3.745	2.750	3.751	3.751	3.756	3.752	3.752	۷ .	1.25	* 359.0	0.085 *	80	1.25 1	0.750	0.104
hT*11**.44		J. 3	0.015	C. C34	0.057	6.676	0.066	0.099	0.113	*****	9 FCSITICN A	1.00	0.650	6.055	9 PCSITION B	1.00 1	****	*****
PT*/TT*		0.0812	0.0665	0.0562	6563.3	0.0311	0.0222	0.0133	9600.0	0.0015		0.75	0.760	C.1C5		0.75	0.690	260.0
*		0.5367	1985.0	1985.0	1955.0	1985.0	1955.0	0.5367	0.5367	0.5367	PIXING STACK FRESSUFE CISTRIBLTION FOR RUN:	0.50	0.850	0.118	MIXING STACK PRESSURE DISTRIBUTION FOR RUN:	C•50	0.720	0.100
£1*		0.0761	C.(623	0.0527	0.0374	0.C291	C.C208	0.C124	0503.0	0.0014	UFE CISTR	(.25	****	***	LRE DISTRI	C.25	C.510	C-126
*		0.0	(.(151	(,(351	0.0551	C.07E2	0.0882	0.1023	C.1160	*****	ACK FRESS	0.0	****	***	ACK PRESS	0.0	****	****
	4									*	IX ING ST	x/E:	FPS(1N. +20):	FPS#:	IXING ST	x/0:	FASCIA. F2C1:	F P S 4 1
~	RLA	-	17	113	4	u1	9	7	a	6	2.		FPS(1K		Σ		FASCIA	

TERTIARY BCX

TABLE XII (c) (CONTINUED)



												UPT MACH		6.064	990.0	990.0	3.064	0.064	0.064	9.064	0.064	0.064
9	2 4	ų vi			_							הה	FT/SEC	75.52	75.42	75.20	75.13	74.55	74.53	65.41	74.67	14.85
2.50 INCHES 2.50 6.502 INCHES	SECTANDARY AREA	SCUARE INCHES	0.0	12.566	25.133	50.265	100.531	150.796	201.062	245.044	***	ž	FT/SEC	72.96	84.14	92.85	108.45	115.23	115.58	126.44	121.27	***
			2.61	ž. 1ž	1.70	1.34	0.57	0.22	0.15	6.11	0.0	J.	F 7 / SEC	182.48	162.25	181.72	181.55	181.21	181.05	181.20	180.91	180.87
LPIAKE CIAMETER: 11.5C INCLES AFEA FATIC, AM/AP: 2.5C CRIFICE CIAMETER: 6.5C2 INCH CRIFICE BET#: 0.457	PA-PG	INCHES OF WATER	2.61	2.12	1.70	1.34	0.57	0.22	0.15	0.11	0.0	S	LBM/SEC	0.0	0.616	1.104	1.960	2.557	2.383	2.623	2.675	****
	PU-FA	JNC.	3.60	4.10	4.50	9.00	5.50	5.70	5.80	5.50	9.00	.	L BM / SEC	3.738	3.741	3.724	3.734	3.734	3.734	3.736	3.732	3.732
	TAPE	11341	82.0	82.0	82.C	82.0	82.0	82.C	82.C	62.(82°C	75.44T*W		o•0	C.16C6	0.2EE3	0.5119	1133.0	0. 6222	0.6844	0.6588	****
υ, ພ	TUPT	DEGREES FAHREN PETT	114.5	114.0	114.0	114.0	114.0	114.0	114.0	114.0	114.0	P*/T*		0.3798	0.3090	0.2493	0.19'8	0.0840	0.0325	0.0221	C.C155	0.0
ACZZLES: 4 AMETER: 3.7C INCHES TF: 29.25 INCHES ETER: 11.70 INCHES	10.8	DEGR	56.9	58.0	60.0	0.39	0.09	0.09	25.0	66.5	60.5	*		0.5434	C-5445	0.5442	X0. 9442	0.5442	0.5442	£ • 5445	27450	0.5442
	CPC		0.55	22.0	22.0	22.0	22.0	22.0	22°C	22 °C	22.0	ī		6.3583	0.2518	6.2354	0.1658	4517.0	0.0307	0.0209	0.C147	0.0
PEIMAN NOZZLE CIAMETER: 3.7C IN PINIAN NOZZLE CIAMETER: 3.7C IN PINIAG STACK LENGTH; 29.25 INCHES PINIAG STACK LIAMETER: 11.70 INCH	PDR	INCHES GF	0.7	1.0	0.7	0.1	7.0	0.1	٥.٦	0.1	0.7	*		0.0	C-1648	9562.0	C. 5245	C.6847	C.6381	0.7015	C.7167	*****
FFIFAR		4		61	m	•	41	•	7	8	5	z	L _B	1	2	ы	4	41	ę	,-	a.	6

(d) TOTAL PERFORMANCE

TABLE XII (CONTINUED)



			•										LPT MACH		0.064	990-0	0.064	0.064	0.064	30.0	0.064	0.064	0.064	
2 P		KEB	2		0 5	· •	3 =		ų,	,	· .		ב	FT/SEC	75.66	75.41	75.30	75.13	75.04	74.54	74.52	74.65	74.63	
LPTAKE CIAMETER: 11.50 INCHES ARE! RITIO, AVIAP: 2.50 ORIFICE OIAMETER: 4.5C2 INCHES CRIFICE BETA: 0.457 AMPIENT PRESSURE: 29.51 INCHES HG	3040000	SCUNDEN KEE) i	12.300	27.02	100.521	100.001	61.004	201002	*****		3	FT/SEC	73.10	84.81	93.76	105.48	114.29	117.67	121.67	122.12	****	
=	DA-ER7	E	5,13	17.6	1.86	1. 14	0.46	0.24	7 .		C. (2	:	۳.	F1/5EC	182.83	182.21	181.96	161.55	181 .33	181.06	181.04	180.8€	180.85	
LPTAKE CIAMETER: 1 ARE& R&TIO, AW/AP: ORIFICE OIAMETER: CRIFICE BETA: 0.45 AMRIENT PRESSURE:	2 d-4 d	INCHES OF MATER	3.13	2.41	1.86	1.14	C - 46	0.24	717	0-11	0.02	3	n \$	LBMISEC	٠. ن	C.661	1.161	1.818	2.310	2.503	2.725	2.753	***	
	PU-FA	INC	3.30	3.80	4 • 30	5.C0	5.60	5.80	05.3	5.90	00.9	٥		LBM/SEC	3	3.7.8	3.758	3.726	3.738	3.738	3.738	3.738	3.728	
	TAPE	NFEIT	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.C	77"##I#M		•	0.0	6.201.	\$10F*1	77/5-0	3.55.6	0.6455	3101-0	0.7153	**	
3 H 3	TLPT	DEGREES FAHRENFEIT	115.5	114.0	114.0	114.0	114.0	113.5	112.5	113.0	113.0	F*/T*			0.4040	6165.0	6212.0		7/90.0	0.0354	0.0236	0.0163	0.0030	
/ NCZZLES: 4 AMETER: 3.7C INCHES (TF: 25.25 INCHES 'STER: 11.70 INCHES : 2.50	TCR	DEC	0.39	55.0	55.0	26.5	55.0	55.0	25.0	0.35	55.0	*		6163 (%	0 6330	0.5338	0.5338	9000	מייילים ע	0.404.0	0.5040	\$655.00 0.00	4004	OPEN
FRY NCZZLES: CIAMETER: NCTH: 25.25 AMETER: 11.	CFCR	OF WATER	22°C	22.0	22.0	22.0	22.0	22.C	22.0	22.0	22°C	ï.		EE C 7 " 0	6.3282	0.2540	0.1564	0.6432	0.5331	1000	177.0		3 70 7 60	RY BOX
NLPEER OF PRIMARY NCZZLES: 4 PEIMARY NOZZLE CIAPETER: 3.7C IN PIDING STACK LENCTF: 25.25 INCHES PIXING STACK DIAPETER: 11.70 INCH	POR	IACPES 0	C • 3	1.0	0.7	0.7	0.7	C.7	0.7	0.7	0.1	T.		0.0	0.17¢E	0.3107	C-4867	0.6180	C.6656	0.7289	6-7366	*****		TERTIARY
NCP EL PIEL PIEL PIEL PIEL PIEL PIEL PIEL	4	FUA	-	2	m	4	u r	•	7	8	σ	z	RUA	-	2	e	4	S	ų	7	ų,	•		(a)

PERFORMANCE DATA FOR PORTED MIXING STACK WITH RING DIFFUSOR AND FLOW-THROUGH SHROUD TABLE XIII.



																		F) 4 F - LJ	;	790°1	******	† 00 · 0	790	7300	* :	0.064	0.064	0.064
			,,		5 H G	A D C A	HEC	,	4		יי			, (. 1		Ξ	7 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	וויינר אי	75 36	76 12	74.99	74.56	37. 95		03.4.	14. 26	74.77
SO TACLES	2.60	05.5	C.S.C. INCHES		29.51 INCHES HG	SECONCION ABEA	SCUARE INCHES	0.0	12.566	25,123	56.265	100.53	150.756	201.062	770-375	*****	à	71/01/	7.00	84.05	63.58	106.29	116.01	115.57	127.46	50.121	124.50	* * * * * * * * * * * * * * * * * * * *
LPTAKE CTAMETER: 11 GO TACLES	AREA RATTO, AWARE		TATE C C C C C C C C C	174.0 . A1.	ESSURE: 2	FA- FA 2		3.54	2.52	1.52	1.20	0.50	0.26	0.18	0.12	0.02	9 .	F1/46C	182.12	181.80	161.53	181.21	180.50	160.66	180.76	, , , ,	00.001	83.087
LPTAKE CTA	AREA RATTO	CRIFICE DIAMETEC.	OPTETCE OF	ONTLOE BEIN: 0.451	AMBIENT PRESSURE:	PA-FS	INCHES OF NATER	3.5.5	2.52	1.52	1.20	0.50	C.26	C.16	0.12	C.C2	∪; - £	LBYZEC))	0.674	1.176	1.660	2.402	2.558	2.882	2.848	0 10 11	} } }
						PL-FA	IN I	3.20	3.70	4.20	05° 5	5.60	5.80	5.50	5.90	9.66	Q.	LBM/SEC	2.741	3.741	3.741	3.741	3.741	3.743	3.741	3-745	3-741	•
						TAPB	NFEIT	J*5L	76.6	19.0	78°C	75.0	19.0	75.0	75.0	75.6	P* 1 * * 4 4		0.0	0.1755	0.3663	0. 1843	0.6253	3.6766	0.75(3	0.7460	*****	
	HES		s			TLPT	OEGREES FAMRENFEIT	112.0	112.0	112.0	112.0	112.0	112.0	112.0	112.0	112.0	P # / 1 4		0.4713	C.3679	0.2811	0.1763	0.0737	0.0383	0.0266	0.0177	0.0030	
S: 4	3.70 INCHES	25 INCHES	ETER: 11.70 INCHES			10R	OEG	58.0	5 & 0	58.0	5.6.0	56.0	51.5	5.60	57.0	58.0	*		0.9423	0.5423	C. 5423	0.9423	0.5423	0.5423	0.5423	C. 5423	0.5423	
ARY ACZZLES:	CIAPETEF:	ENGTH; 25.	IAPETER: 1]	/F: 2.50		OFCF	OF HATER	22°C	22.0	22°C	22.0	22.0	22.0	22.0	22.0	22.0	4		0.4441	0.3466	C.2649	0.1661	0.0695	0.0361	0.6250	0.6167	0.0028	
ALPEER CF PRIMARY	FFIMARY NOZZLE C	HIXING STACK LENGTH; 25.25 INCHES	MINING STACK DIAM	MIDING STACK LVF:		FCR	U 3	0.7	0.7	0.7	0.7	0.7	0.7	0.7	C•3	0.7	7		٥٠,	0.1601	C.3144	0.4972	0.6415	0.6940	0.7702	C. 7657	******	
N. P. E	FFIV	HIXI	MIVI	HIST		Z	FUF	-	7	eı.	4	u i	ų	7	8	6	z	۲ <u>۶</u>	-	2	P)	4	ς.	ų.	7	8	5	

TABLE XIII (CONTINUED)

TERTIARY BOX CLOSED

(p)



S/C*.5; THRU FLCW SHRCUC ANC CIFFUSOR RING ON PORTED STACK, JERT. BCX CCNTRCLLEC CATA TAKEN ON 25 AUGUST BY LEMKE AND STAEFLY

				(3	EA TERTIAFY AREA	S SQUARE INCHES	0.0	3.142	6.283	12.566	18.850	25, 133	37.699	50.265	****		UL LFT MACH	F1/5EC	74.60 0.064	74.84 6.664	74.76 0.Ce4	74.77 0.064		4.77 0.064		74.70 0.064	74.62 0.064
.50 INCHES	2.50	CRIFICE DIAMETER: 4.5C2 INCHES		29.91 INCHES HG	SECCNEARY AREA	SCUAFE INCHES	***	*****	***	****	****	****	****	*****	****		5	FT/SEC F		****	*****	****	***	****	* * * * * *	****	****
ETEF: 11		PETER:	A: 0.497		FA-F1	Œ.	57.0	0.22	0.17	0.11	0.08	0.05	0.03	0.02	0.0		LF	F1/5EC	180.74	186.83	186.66	180.67	186.67	186.67	180.67	186.50	180.82
LFTAKE CLAMETER: 11.50 INCHES	AREA RATIO, AM/AP:	RIFICE DIA	ORIFICE BETA: 0.497	AMEIENT PRESSURE:	P A-P S	INCHES CF NATER	0.0	0.0	0.0	0.0	0.0) • <u>)</u>	J.,	J•0	0.0		S	LBF/SEC	*****	****	****	***	*****	****	*****	****	****
ر	•	•	0	•	PU-F∌	INC	03.9	6.00	00.9	6.00	9.00	6.00	00.9	00.9	00.9		A P	L BM/SEC	2.740	3.741	3.738	3.741	3.741	3.741	3.741	3.738	3.738
					TAPB	IFE1T	36.08	90.08	80.0	80.0	80.0	80.0	80°C	80.0	90.0		75°**L*4		******	*****	******	******	******	******	*****	*****	*****
	ES				TUPT	OEGREES FAHRENFELT	112.5	112.5	112.5	112.0	112.0	112.0	112.0	112.0	113.0		*1/*d		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	ETER: 3.7C INCHES	: 29.25 INCHES	ER: 11.70 INCHES		TOR	OEGR	56.5	56.0	55.0	58.0	58.0	56.0	96.0	0.55	99.0		<u>*</u>		0.5432	C. 5432	0.5432	0 7 5 7 4 0	0 + 5 + 4 0	0.5440	ؕ5440	0.5440	0.5424
RY ACZZLES:				C: 2.50	OFCR	F WATER	22.0	52.0	22.0	22.0	22.0	55.0	22.0	22.0	22.0		ů.		0.0	·.	٥.0	J•0	0.0	0.0)·0	0.0	0.0
ALPEER OF PRIMARY	FFIMARY NOZZLE CIAM	PIXING STACK LENGTH	MINING STACK DIAMET	PIXING STACK L/E:	FCR	INCHES OF	1.0	T. 0	C-7	1.0	0.7	0.7	7.0	C.7	1.0	IF) ECX	*		******	******	****	******	*****	******	*****	******	*****
NLPEE	FF1 14	4 1 X 1 A	MIVIN	FIXIA	2	FLA	1	2	C)	4	W)	ę	7	8	5	SECCNETEN	z	RLh	1	2	æ	4	uı	9	-	ę	5

(c) TERTIARY BOX CONTROLLED

TABLE XIII (CONTINUED)



z		* 1 4	£1.	*11	PT*/TT*	77 24. TAN	74 9·	7	د د	ų,
RUA							LBM/SEC	LB*/SEC	FT/SEC	FT/SEC
	-	0.0	0.0397	0.5432	0.0421	0.0	3.740		****	50.54
2	-	C.C133	6.(366	6.5432	0.0325	C.C13	3.741		****	51.24
m	•	C.0235	C.C240	C.5432	0.0254	0.623	3.738	60.0	***	51.71
4	_	0.0371	0.C145	C.5440	0.0158	9€0.0	3.741		****	52.40
u,	-	C.0475	(-(16	C.5440	0.0115	0.046	3.741		***	52.52
9	•	C.0497	0.0067	0445.3	0.0071	0.048	3.741	C-15	****	53.03
7	-	5953*3	5600.0	C. 544C	0.0041	550.0	3.741	0.21	***	52.40
w	-	6.0556	0.0021	0.5440	0.0022	0.054	3.736	C.21	***	\$3.2E
5	*	****	0.0	0.5424)·0	****	3.738	****	****	50.56
.	XING ST	ACK PRESSI	PIXING STACK PRESSURE CISTRIBUTION FOR RUN:	IBUTION FC		9 POSITION A	۹ z			
	:)/(0.0	0.25	0.50	0.75	1.00	1.25	1.50		
F + S (IN .	FPS(IN. P2C):	****	****	096.0	0.880	C.82C	0.746	****		
	FFS#	****	****	0.134	C-123	C-114	0.103	****		
	X ING ST.	ACK PRESS	PIXING STACK PRESSURE DISTRIBUTION FOR RUN:	BUTICN FO		9 POSITION 8	0 2			
	: 0/x	0.0	0.25	.C.50	67.0	1.00	1.25	1.50		
FPS(1h. +2C):	. F2C):	****	1.020	0.890	0.790	****	0.830	0.730		
	PM 5#:	***	C-142	0.124	0.110	****	0.116	0.162		

TEFTIAFY BCX

TABLE XIII (c) (CONTINUED)



																LPT MACH		0.064	0.064	490.0	0.064	C-064	0.064	0.064	0.064	0.064
				9 H C	AREA	;+E¢		9	13	u.	.1	9	17	4	*	ະ	F 17 SEC	75.45	15.31	75.26	75.16	74.50	14.93	74.51	14.50	74.85
50 INCHES	2.50	€.502 INCHES		29.91 INCHES HG	SECCHCARY AREA	SCLARE INCHES	0.0	12.566	25.133	50.265	100.531	150.756	201.062	545.C44	****	ŝ	F1/5EC	72.69	83.90	95.81	105,19	114.30	116.88	120.28	122,36	* * * * * * *
LPTAKE CIAMETER: 11.50 INCHES	AFEA RITIC. AMIRE: 2.50		TA: (.457		FA-FAZ	E	2.66	2.06	1.70	1.11	0.46	0.23	0.15	0.11	03.0	5	F1/5EC	182.32	181.57	18 1.7 1	181.63	166.55	181.06	181.02	16C.55	180.67
LPTAKE CIA	AFEA FATIC	ORIFICE DIAPETER:	ORIFICE BETA: (.457	AMEIENT PRESSURE:	PA-PS	INCHES OF WATER	2.66	2.08	1.70	1.11	2.46	0.23	0.15	C.11	22.2	J,	LBMISEC	J.,	6.412	1.16	1.787	30J	2.441	2.628	5.143	* * * * * * * * * * * * * * * * * * * *
			Ū		PU-F#	INC	3. 50	4 • 00	4.50	5 •00	5.50	5.70	5.80	35.3	6. CO	u. E	L8M/SEC	3.738	2.736	3.734	3.736	3.731	3.734	3.734	3.721	3.732
					TAFB	HEIT	90°C	80.0	80.0	90.0	80.0	3.08	80.0	3.38	80°C	b 4		0.0	0.1554	C. 2863	0.4655	5339.3	0.6363	0.6852	0.7155	***
	¥.				TUPT	DEGREES FAHRENHEIT	114.0	114.0	114.0	114.0	114.0	114.0	114.0	114.5	114.0	*1/*d		C. 3874	0.3041	0.2453	0.16 29	0.0680	0.0340	0.0222	0.0163	0.0007
7	IAMETEF: 2.7C INCHES	5 INCHES	ETER: 11.70 INCHES		1 CR	OE GR	59.0	55.5	0.09	55.0	61.0	66.0	0.09	61.0	60.5	*		0.5407	C.5407	0.9407	0.5407	C. 5407	C.5407	0.5407	0.9399	C. 5407
RY ACZZLES:		NGTH: 29.25 INCHES	_	05.5 :0	0000	F WATER	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	÷ d		0.3645	0.2861	C.2345	0.1533	0.646	0.6320	C.C208	0.0153	0.0007
NIPEER CF PRIMAR	FFIFARY NOZZIE C	MIXING STACK LEN	MIXING STACK DIA	NG STACK L/C	FCR	INCHES OF	0.7	7.0	7.0	0.7	0.7	0.7	0.7	۲.2	0.7	*		0.0	C.1637	(.2562	0.4762	C. 6165	1559.0	C. 703 E	C.7353	•
ALPE	FFIM	HIVI	MIXI	FIXING	z.	5	-	2	En.	4	ĸ	ę	7	a	6	z	5	1	(VI	111	4	2	9	۲	æ	پ

TOTAL PERFORMANCE

(q)

(CONTINUED)

TABLE XIII



CATA TAKEN ON 1 FE8 1978 BY LEMKE AND STAEFL1 \$/C=.5; L/C= 3.0 STRAIGHT STACK: 4 NCZZLES(2.38 IN.)

AMEIENT PRESSURE = 3C.500 IN.HGA, TEMPERATURE = 74.0 DEG.FAFR FFIMARY (LPTAKE) TEMPERATURE = 116.2 DEG.FAHR

C.O 5.675 1.80 1.25 91.2 76.0 0.7172 0.5577 0.4235 0.3525 C.50C 5.375 4.30 2.60 141.0 109.6 1.1085 0.662C 0.6545 0.5050 1.00C 4.675 4.65 2.7C 146.6 111.7 1.1527 0.6784 C.68C7 0.5187 1.5CC 4.375 5.00 2.55 152.0 116.8 1.1953 0.5181 C.7058 0.5421 2.000 2.875 5.00 2.25 152.0 116.8 1.1953 0.5862 0.7CE8 0.5421 2.000 2.875 5.00 2.20 152.0 121.6 1.1953 0.5862 0.7CE8 0.5421 2.000 2.875 4.70 3.40 147.4 125.4 1.1589 0.5862 0.7CE8 0.5421 2.001 2.25 1.016 1.1085 0.5647 0.5647 0.5647 2.001 1.25 3.25 131.7 <	* 1NC	FES R	PTA In.H	PTE -20	VA FT/	SEC	VA/VAV	V6/VAV	VA/LF	VB/LF
1.000 4.675 4.65 2.70 146.6 111.7 1.1527 0.6764 C.6807 0.5187 1.500 4.275 5.00 2.55 152.0 116.8 1.1953 0.5161 C.7058 0.5471 2.000 2.875 5.00 2.20 152.0 121.6 1.1953 0.9562 0.7058 0.5647 2.500 3.375 4.70 3.40 147.4 125.4 1.1589 0.9657 0.6843 0.5620 2.000 2.875 4.30 3.60 141.0 129.0 1.1085 1.0142 0.6545 0.5985 2.500 2.275 4.00 3.80 136.0 132.5 1.0691 1.0420 0.6313 0.6153 4.000 1.675 3.80 3.75 132.5 131.7 1.0420 1.0252 0.6153 0.6113 4.500 1.275 3.60 3.60 129.0 1.0143 1.0143 0.5985 0.5985 5.000 0.275 3.35 3.50 124.4 127.2 0.5784 1.0001 0.5777 <t< td=""><td>C.O</td><td>5.875</td><td>1.80</td><td>1.25</td><td></td><td></td><td>0.7172</td><td>0.5577</td><td>0.4235</td><td>0.3529</td></t<>	C.O	5.875	1.80	1.25			0.7172	0.5577	0.4235	0.3529
1.5CC 4.275 5.00 2.55 152.0 116.8 1.1953 0.5181 C.7C58 0.5421 2.000 2.875 5.00 2.20 152.C 121.6 1.1953 0.5562 0.7C58 0.5647 2.50C 3.375 4.70 3.40 147.4 125.4 1.1589 0.5857 0.6843 0.562C 2.6CC 2.875 4.30 3.60 141.0 129.0 1.1085 1.C142 0.6545 0.5588 3.50C 2.275 4.CO 3.6C 136.0 132.5 1.0691 1.0420 0.6313 0.6153 4.00C 1.875 3.80 3.75 132.5 131.7 1.0420 1.0352 0.6152 0.6113 4.500 1.275 3.60 3.60 125.0 129.0 1.0143 1.0142 0.5965 0.5588 5.0CC 0.875 3.35 3.5C 124.4 127.2 C.5784 1.00C1 0.5777 0.5505 5.50C 0.275 3.30 3.40 123.5 125.4 C.9711 0.5657 0.5724 0.5820 6.CCC 0.625 3.30 3.5C 123.5 127.2 0.6711 1.00C1 0.5724 0.5505 6.5CC 0.625 3.30 3.5C 123.5 127.2 128.1 1.0001 1.CC72 0.5505 0.5547 7.00C 1.125 3.65 3.7C 129.5 130.8 1.0213 1.0262 0.6030 0.6072 7.50C 1.625 3.50 3.6C 134.3 132.5 1.0557 1.042C 0.6234 0.6153 6.CCC 2.125 4.25 3.50 140.2 134.3 1.020 1.0557 0.6577 0.6234 6.50C 2.125 4.25 3.50 140.2 134.3 1.1020 1.0557 0.6577 0.6234 6.50C 2.125 4.25 3.50 140.2 134.3 1.1020 1.0557 0.6567 0.6234 6.50C 2.125 4.25 3.50 140.2 134.3 1.1020 1.0557 0.6567 0.6234 6.50C 2.125 4.25 3.50 140.2 134.3 1.1020 1.0557 0.6567 0.6234 6.50C 2.125 4.25 3.50 140.2 134.3 1.1020 1.0557 0.6567 0.6234 6.50C 2.125 4.25 3.50 140.2 134.3 1.1020 1.0557 0.6567 0.6234 6.50C 2.125 4.85 3.45 149.7 126.3 1.1772 0.5525 0.6551 0.5863 6.50C 3.625 4.90 3.15 150.5 120.7 1.1833 0.5467 0.6567 0.6072 6.50C 3.625 4.90 3.15 150.5 120.7 1.1833 0.5467 0.6567 0.6562 1.050C 4.625 4.70 2.75 147.4 112.7 1.1589 0.6865 0.6672 0.5224 11.000 5.125 4.20 2.50 135.3 107.5 1.0955 0.6570 0.4662 0.4615 11.50C 5.625 2.20 1.7C 100.8 88.6 0.7529 0.6570 0.4662 0.4116	C.50C	5.375	4.30	2.60	141.0	109.6	1.1085	0.8620	0.6545	0.5050
2.000 2.875 5.00 3.40 147.4 125.4 1.1589 0.5662 0.7058 0.5647 2.500 3.375 4.70 3.40 147.4 125.4 1.1589 0.5657 0.6843 0.5620 3.000 2.875 4.30 3.60 141.0 129.0 1.1085 1.0142 0.6545 0.5586 3.500 2.375 4.00 3.60 136.0 132.5 1.0691 1.0420 0.6313 0.6153 4.000 1.875 3.80 3.75 132.5 131.7 1.0420 1.0252 0.6152 0.6113 4.500 1.375 3.60 3.60 125.0 129.0 1.0143 1.0142 0.5985 0.5586 5.000 0.875 3.35 3.50 124.4 127.2 0.5784 1.0001 0.5717 0.5505 5.500 0.375 3.30 3.40 123.5 127.2 0.5711 0.0601 0.5717 0.5505 6.500 0.375 3.30 3.40 123.5 127.2 0.5711 1.0001 0.5724 0.5505 6.500 0.625 3.50 3.55 127.2 128.1 1.0001 1.0001 0.5724 0.5505 6.500 0.625 3.50 3.55 127.2 128.1 1.0001 1.0002 0.5505 0.5547 7.000 1.125 3.65 3.70 129.5 130.8 1.0213 1.0282 0.6030 0.6072 7.500 1.621 3.50 3.60 134.3 132.5 1.0557 1.0420 0.6224 0.6153 8.000 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6655 0.6072 9.000 4.125 5.10 2.50 153.5 115.8 1.1772 0.5525 0.5521 0.5863 9.500 4.625 4.90 3.15 150.5 120.7 1.1833 0.5487 0.6967 0.5863 9.500 4.625 4.90 3.15 150.5 120.7 1.1833 0.5487 0.6967 0.5924 11.000 5.125 4.20 2.50 135.3 107.5 1.0955 0.8452 0.6465 0.4615 11.500 5.125 4.20 2.50 135.3 107.5 1.0955 0.8452 0.6465 0.4615 11.500 5.125 4.20 2.50 135.3 107.5 1.0955 0.8452 0.6465 0.4615	1.000	4.875	4.65	2.70	146.6	111.7	1.1527	0.8784	C.68C7	0.5187
2.50C	1.500	4.375	5.00	2.55	152.0	116.8	1.1953	0.9181	C.7058	0.5421
2.CCC 2.875 4.30 3.60 141.0 129.0 1.1085 1.C142 0.6545 0.5588 3.5CC 2.375 4.CQ 3.80 136.0 132.5 1.0691 1.0420 0.6313 0.6153 4.0CC 1.875 3.80 3.75 132.5 131.7 1.0420 1.0352 0.6113 0.6113 4.500 1.375 3.60 3.60 125.0 129.0 1.0143 1.0142 0.5965 0.5788 5.0CC 0.875 3.35 3.5C 124.4 127.2 C.5784 1.0CC1 0.5777 0.5505 5.5CC 0.375 3.30 3.40 123.5 127.4 C.9711 C.5857 0.5724 0.5820 6.5CC 0.225 3.50 3.5C 123.5 127.2 C.9711 1.0CC1 0.5724 0.5505 6.5CC 0.625 3.50 3.55 127.2 128.1 1.0001 1.CC72 0.5505 0.5547 7.00C	2.000	3.875	5.00	3.20	152.C	121.6	1.1953	0.5562	0.7058	0.5647
3.50C 2.275 4.00 3.80 136.0 132.5 1.0691 1.0420 0.6313 0.6153 4.00C 1.675 3.80 3.75 132.5 131.7 1.0420 1.0352 0.6153 0.6113 4.500 1.275 3.60 3.60 125.0 129.0 1.0143 1.0143 0.5985 0.5985 5.00C 0.675 3.35 3.50 124.4 127.2 0.5784 1.0001 0.5777 0.5505 5.50C 0.275 3.30 3.40 123.5 127.2 0.5711 0.001 0.5724 0.5505 6.50C 0.625 3.50 3.55 127.2 128.1 1.0001 1.0001 0.5734 0.5505 6.50C 0.625 3.50 3.55 127.2 128.1 1.0001 1.0072 0.5505 0.5547 7.00C 1.125 3.65 3.70 129.5 130.8 1.0213 1.0262 0.6030 0.6072 7.50C 1.625 3.50 3.60 134.3 132.5 1.0557 1.0420	2.500	3.375	4.70	3.40	147.4	125.4	1.1589	0.5857	0.6843	0.5820
4.00C 1.875 3.80 3.75 132.5 131.7 1.0420 1.0352 0.6152 0.6113 4.500 1.275 3.60 3.60 125.0 129.0 1.0143 1.0145 0.5985 0.5585 5.0CC 0.675 3.35 3.5C 124.4 127.2 0.5784 1.0CC1 0.5777 0.5505 5.50C 0.375 3.30 3.40 123.5 127.2 0.5711 0.5857 0.5724 0.5820 6.CCC 0.125 3.30 3.5C 123.5 127.2 0.5711 1.0001 0.5724 0.5905 6.5CC 0.625 3.50 3.55 127.2 128.1 1.0001 1.0C72 0.59C5 0.5947 7.00C 1.125 3.65 3.70 129.9 130.8 1.0213 1.0282 0.6030 0.6072 7.50C 1.625 3.50 3.6C 134.3 132.5 1.0557 1.042C 0.6234 0.6153 8.00C 2.125 4.25 3.50 140.2 134.3 1.1020 1.0557 <td< td=""><td>3.000</td><td>2.875</td><td>4.30</td><td>3.60</td><td>141.0</td><td>129.0</td><td>1.1085</td><td>1.0143</td><td>0.6545</td><td>0.5989</td></td<>	3.000	2.875	4.30	3.60	141.0	129.0	1.1085	1.0143	0.6545	0.5989
4.500 1.275 3.60 3.60 125.0 129.0 1.0143 1.0142 0.5985 0.5985 5.000 0.875 3.35 3.50 124.4 127.2 0.5784 1.0001 0.5777 0.5505 5.500 0.375 3.30 3.40 123.5 127.2 0.5711 0.5857 0.5734 0.5820 6.000 0.625 3.30 3.50 123.5 127.2 0.5711 1.0001 0.5734 0.5905 6.500 0.625 3.50 3.55 127.2 128.1 1.0001 1.0001 0.5734 0.5905 6.500 0.625 3.50 3.55 127.2 128.1 1.0001 1.0001 0.5734 0.5905 6.500 1.125 3.65 3.70 129.9 130.8 1.0213 1.0262 0.6030 0.6072 7.500 1.625 3.90 3.60 134.3 132.5 1.0557 1.0420 0.6224 0.6153 8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0262 <td< td=""><td>3.50C</td><td>2.375</td><td>4.CO</td><td>3.80</td><td>136.0</td><td>132.5</td><td>1.0691</td><td>1.0420</td><td>0.6313</td><td>0.6153</td></td<>	3.50C	2.375	4.CO	3.80	136.0	132.5	1.0691	1.0420	0.6313	0.6153
5.0CC C.875 3.35 3.5C 124.4 127.2 C.9784 1.0CC1 0.5777 0.5905 5.50C O.375 3.30 3.40 123.5 127.4 C.9711 C.9857 0.5734 0.5820 6.CCC C.125 3.30 3.5C 123.5 127.2 C.9711 1.00C1 0.5734 0.5905 6.5CC 0.625 3.50 3.55 127.2 128.1 1.0001 1.0C72 0.55C5 0.5547 7.00C 1.125 3.65 3.7C 129.5 130.8 1.0213 1.0282 0.6030 0.6072 7.5CC 1.625 3.60 3.6C 134.3 132.5 1.0557 1.042C 0.6234 0.6153 8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6657 0.6627 9.5CC 2.125 4.85 3.45 145.7 126.3 1.1772 0.9525 0.6951 0.5863 9.5CC 3.625 4.90 3.15 150.5 120.7 1.1833 0.9487 <td< td=""><td>4.00C</td><td>1.875</td><td>3.80</td><td>3.75</td><td>132.5</td><td>131.7</td><td>1.0420</td><td>1.0352</td><td>0.6153</td><td>0.6113</td></td<>	4.00C	1.875	3.80	3.75	132.5	131.7	1.0420	1.0352	0.6153	0.6113
5.50C 0.375 3.30 3.40 123.5 125.4 C.9711 C.9857 0.5724 0.5820 6.CCC C.125 3.30 3.5C 123.5 127.2 C.9711 1.C0C1 0.5724 0.5905 6.5CC 0.625 3.50 3.55 127.2 128.1 1.0001 1.CC72 0.55C5 0.5547 7.000 1.125 3.65 3.70 129.9 130.8 1.0213 1.C282 0.6C30 0.6072 7.5CC 1.625 3.90 3.8C 134.3 132.5 1.0557 1.C42C 0.6224 0.6153 8.CCC 2.125 4.25 3.90 140.2 134.3 1.1020 1.0557 0.65C7 0.6234 8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6659 0.6072 9.CCC 3.125 4.85 3.45 149.7 126.3 1.1772 0.9525 0.6951 0.5862 9.5CC 3.625 4.90 3.15 150.5 120.7 1.1833 0.5467 <td< td=""><td>4.500</td><td>1.375</td><td>3.60</td><td>3.60</td><td>125.0</td><td>129.0</td><td>1.0143</td><td>1.0143</td><td>0.5985</td><td>0.5989</td></td<>	4.500	1.375	3.60	3.60	125.0	129.0	1.0143	1.0143	0.5985	0.5989
6.CCC C.125 3.30 3.5C 123.5 127.2 C.5711 1.COC1 0.5734 0.5505 6.5CC 0.625 3.50 3.55 127.2 128.1 1.0001 1.CC72 0.55C5 0.5947 7.COC 1.125 3.65 3.7C 129.9 130.8 1.0213 1.C282 0.6C30 0.6072 7.50C 1.625 3.50 3.8C 134.3 132.5 1.0557 1.C42C 0.6234 0.6153 8.CCC 2.125 4.25 3.90 14C.2 134.3 1.1020 1.0557 0.65C7 0.6234 8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6659 0.6072 9.CCC 3.125 4.85 3.45 149.7 126.3 1.1772 0.9929 0.6951 0.5863 9.5CC 3.625 4.90 3.15 15C.5 12O.7 1.1833 0.9487 0.6987 0.6987 0.56C2 1C.000 4.125 5.1C 2.9C 153.5 115.8 1.2072 0.91C3 0.7128 0.5375 1C.50C 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5234 11.000 5.125 4.20 2.50 139.3 107.5 1.0955 C.8452 0.6469 0.4991 11.5CC 5.625 2.20 1.7C 100.8 88.6 C.7529 0.697C 0.4682 0.4116	5.000	0.875	3.35	3.5C	124.4	127.2	C.5784	1.0001	0.5777	0.5905
6.5CC 0.625 3.50 3.55 127.2 128.1 1.0001 1.CC72 0.55C5 0.5547 7.000 1.125 3.65 3.70 129.9 130.8 1.0213 1.0282 0.6030 0.6072 7.500 1.625 3.50 3.80 134.3 132.5 1.0557 1.0420 0.6234 0.6153 8.000 2.125 4.25 3.50 140.2 134.3 1.1020 1.0557 0.6507 0.6234 8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6659 0.6072 9.000 3.125 4.85 3.45 149.7 126.3 1.1772 0.9929 0.6951 0.5862 9.500 3.625 4.90 3.15 150.5 120.7 1.1833 0.9487 0.6987 0.5602 10.000 4.125 5.10 2.90 153.5 115.8 1.2072 0.9103 0.7128 0.5375 10.500 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5224 11.000 5.125 4.20 2.50 139.3 107.5 1.0955 0.8452 0.6469 0.4991 11.500 5.625 2.20 1.70 100.8 88.6 0.7529 0.6970 0.4682 0.4116	5.500	0.375	3.30	3.40	123.5	125.4	C.9711	C.9857	0.5734	0.5820
7.000 1.125 3.65 3.70 129.9 130.8 1.0213 1.0282 0.6030 0.6072 7.500 1.625 3.90 3.80 134.3 132.5 1.0557 1.0420 0.6234 0.6153 8.000 2.625 4.25 3.90 140.2 134.3 1.1020 1.0557 0.6507 0.6234 8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6659 0.6072 9.000 3.125 4.85 3.45 149.7 126.3 1.1772 0.9929 0.6951 0.5862 9.500 3.625 4.90 3.15 150.5 120.7 1.1833 0.9487 0.6987 0.5602 10.000 4.125 5.10 2.90 153.5 115.8 1.2072 0.9103 0.7128 0.5375 10.500 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5224 11.000 5.125 4.20 2.50 139.3 107.5 1.0955 0.8452 0.6469 0.4991 11.500 5.625 2.20 1.70 100.8 88.6 0.7529 0.6970 0.4682 0.4116	6.000	C.125	3.30	3.5C	123.5	127.2	C.5711	1.0001	0.5734	0.5905
7.50C 1.625 3.50 3.8C 134.3 132.5 1.0557 1.C42C 0.6234 0.6153 8.CCC 2.125 4.25 3.50 14C.2 134.3 1.1020 1.0557 0.65C7 0.6234 8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6655 0.6072 9.CCC 3.125 4.85 3.45 145.7 126.3 1.1772 0.5525 0.6551 0.5863 9.5CC 3.625 4.90 3.15 15C.5 120.7 1.1833 0.5487 0.6587 0.6587 0.5602 10.000 4.125 5.10 2.5C 153.5 115.8 1.2072 0.51C3 0.7128 0.5375 10.50C 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5234 11.000 5.125 4.20 2.50 135.3 107.5 1.0955 0.8452 0.6465 0.4551 11.5CC 5.625 2.20 1.7C 100.8 88.6 0.7529 0.657C 0.4682 0.4116	6.500	0.625	3.50	3.55	127.2	128.1	1.0001	1.0072	0.5905	0.5547
E.CCC 2.125 4.25 3.90 140.2 134.3 1.1020 1.0557 0.6507 0.6234 8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6655 0.6072 9.000 3.125 4.85 3.45 149.7 126.3 1.1772 0.9325 0.6951 0.5862 9.500 3.625 4.90 3.15 150.5 120.7 1.1833 0.9467 0.6967 0.5862 10.000 4.125 5.10 2.90 153.5 115.8 1.2072 0.9103 0.7126 0.5375 10.500 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5234 11.000 5.125 4.20 2.50 135.3 107.5 1.0955 0.6465 0.4665 0.4665 11.500 5.625 2.20 1.70 100.8 88.6 0.7529 0.6670 0.4662 0.4116	7.000	1.125	3.65	3.70	129.5	130.8	1.0213	1.0282	0.6030	0.6072
8.500 2.625 4.45 3.70 143.4 130.8 1.1277 1.0282 0.6659 0.6072 9.000 3.125 4.85 3.45 149.7 126.3 1.1772 0.9929 0.6951 0.5862 9.500 3.625 4.90 3.15 150.5 120.7 1.1833 0.9487 0.6987 0.6987 0.5602 10.000 4.125 5.10 2.90 153.5 115.8 1.2072 0.9103 0.7128 0.5375 10.500 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5224 11.000 5.125 4.20 2.50 139.3 107.5 1.0955 0.8452 0.6469 0.4991 11.500 5.625 2.20 1.70 100.8 88.6 0.7529 0.6970 0.4682 0.4116	7.50C	1.625	3.50	3.80	134.3	132.5	1.0557	1.0420	0.6234	0.6153
\$.CCC 3.125 4.85 3.45 149.7 126.3 1.1772 0.9925 0.6951 0.5862 \$.5CC 3.625 4.90 3.15 150.5 120.7 1.1833 0.9467 0.6967 0.5602 10.000 4.125 5.10 2.90 153.5 115.8 1.2072 0.9103 0.7126 0.5375 10.500 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5234 11.000 5.125 4.20 2.50 135.3 107.5 1.0955 0.6452 0.6465 0.4951 11.500 5.625 2.20 1.70 100.8 88.6 0.7529 0.6570 0.4682 0.4116	8.CCC	2.125	4.25	3.90	140.2	134.3	1.1020	1.0557	0.65(7	0.6234
5.5CC 3.625 4.90 3.15 15C.5 12O.7 1.1833 0.5467 0.6567 C.56C2 1C.00C 4.125 5.1C 2.9C 153.5 115.8 1.2072 0.91C3 0.7126 0.5375 1C.50C 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5234 11.000 5.125 4.20 2.50 135.3 107.5 1.0955 C.8452 0.6465 0.4681 11.5CC 5.625 2.20 1.7C 100.8 88.6 C.7529 0.657C 0.4682 0.4116	8.500	2.625	4.45	3.70	143.4	130.8	1.1277	1.0282	0.6659	0.6072
1C.COC 4.125 5.1C 2.5C 153.5 115.8 1.2072 0.51C3 0.7128 0.5375 1C.5OC 4.625 4.7O 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5234 11.000 5.125 4.2O 2.5O 135.3 107.5 1.0955 C.8452 0.6465 0.4591 11.5CC 5.625 2.2O 1.7C 100.8 88.6 C.7529 0.657C 0.4682 0.4116	9.000	3.125	4 • 85	3.45	145.7	126.3	1.1772	0.9929	0.6951	0.5863
1C.50C 4.625 4.70 2.75 147.4 112.7 1.1589 0.8865 0.6843 0.5234 11.000 5.125 4.20 2.50 135.3 107.5 1.0955 C.8452 0.6465 0.4551 11.5CC 5.625 2.20 1.7C 100.8 88.6 C.7529 0.657C 0.4682 0.4116	9.5CC	3.625	4.90	3.15	150.5	120.7	1.1833	0.5487	0.6587	C.5602
11.000 5.125 4.20 2.50 135.3 107.5 1.0955 C.8452 0.6465 0.4551 11.5CC .5.625 2.20 1.7C 100.8 88.6 C.7529 0.657C 0.4682 0.4116	10.000	4.125	5.10	2 • 5 C	153.5	115.8	1.2072	0.9103	0.7128	0.5375
11.5CC · 5.625 2.20 1.7C 100.8 88.6 C.7529 0.657C 0.4682 0.4116	1C.50C	4.625	4.70	2.75	147.4	112.7	1.1589	0.8865	0.6843	0.5234
	11.000	5.125	4.20	2.50	135.3	107.5	1.0955	C.8452	0.6469	0.4551
11.75C 5.875 2.20 1.3C 100.8 77.5 C.7929 C.6C55 O.4682 O.3555	11.5CC	5.625	2.20	1.70	100.8	88.6	C. 7529	0.6570	0.4682	0.4116
	11.750	5.875	2.20	1.30	100.8	77.5	G.7929	0.6095	0.4682	0.3599

INTEGRATED FLCW RATE = \$5.77 CU.FT/SEC = 6.525 LBM/SEC

AVERACE VELOCITY = 127.18 FT/SEC

FFIMARY FLGH RATE, WP = 3.765 LEM/SEC

FFIMARY VELOCITY, LP = 215.38 FT/SEC

MCMENTLM FACTOR, KM = 1.017

(a) L/D = 3.0

TABLE XIV. EXIT VELOCITY DATA FOR A STRAIGHT MIXING STACK WITH 3.38 IN. NOZZLES



EATA TAKEN ON 27 FEB 1978 BY LEMKE AND STAFFLI S/C=.5; L/C= 2.5 STRAIGHT STACK; 4 NG22LES(3.38 IN.)

AMBIENT PRESSURE = 29.810 IN.HGA, TEMPERATURE = 78.0 DEG.FAHR FFIMAFY (UPTAKE) TEMPERATURE = 112.5 DEG.FAHR

×	⊦ES ^R	PTA IN.	P T 8 F20	VA FT/	SECVB	VA/VAV	V & / V & V	VA/LP	V8/UF
C • C	5.875	1.05	1.05	70.4	70.4	0.5364	0.5364	0.3238	0.3238
C.5CC	5.375	3.30	1.70	124.5	89.6	C.5509	0.6825	0.5740	0.4120
1.000	4.875	4.35	1.50	143.4	54.8	1.0917	0.7215	0.6590	0.4355
1.500	4.375	4.55	2.15	152.5	100.8	1.1646	0.7675	0.7030	0.4633
2.000	3.875	5.80	2.65	165.6	111.5	1.2606	0.8521	0.7610	0.5144
2.50C	2.275	6.20	3.1C	171.2	121.0	1.3033	0.9216	0.7868	0.5563
3.000	2.875	5.50	3.50	167.0	128.6	1.2714	0.9792	0.7675	0.5911
3.500	2.375	5.45	3.75	160.5	133.1	1.2220	1.0136	0.7376	0.6115
4.000	1.875	4.70	3.50	149.0	135.8	1.1348	1.0337	0.6850	0.6240
4.500	1.375	3.9C	3.65	135.8	131.3	1.0327	1.CCCC	0.6240	0.6037
5.000	C.875	2.50	3.40	128.6	126.8	C. 9752	C.9652	0.5511	0.5826
5.5CC	C.275	3.25	3.25	123.9	123.9	C.9436	0.5436	0.5696	0.5696
6.000	0.125	3.10	3.15	121.0	122.0	C-9216	C-929C	0.5563	0.5608
6.5CC	C.625	3.20	3.40	123.0	126.8	C.9363	0.9652	0.5652	0.5826
7.000	1.125	3.40	3.15	126.8	129.5	C -9652	0.5862	0.5826	0.5953
7.500	1.625	3.70	3.70	132-2	132.2	1.0068	1.0068	0.6078	0.6078
8.0CC	2.125	4.00	3.85	137.5	134.9	1.0469	1.0270	0.6319	0.6200
8.50C	2.625	4.50	3.75	145.8	133.1	1.1104	1.0136	0.6703	0.6115
5.0CC	1.125	5.10	3.65	155.2	131.3	1.1821	1.0000	0.7136	0.6037
9.500	3.625	5.90	3.40	167.0	126.8	1.2714	0.9652	0.7675	C.5826
10.000	4.125	6.30	2.80	172.5	115.0	1.3138	0.8759	0.7931	0.5287
1C.50C	4.625	6.00	2 • C	168.4	110.8	1.2821	C.844G	0.7740	0.5095
11.000	5.125	5.40	2.70	159.7	113.0	1.2163	0.8661	0.7343	0.5152
11.5CC	5.625	4.20	2.30	140.5	104.3	1.3727	0.7928	0.6475	0.4792
11.75C	5.875	1.60	1.35	87.0	79.9	0.6621	0.6082	0.3997	0.3671

INTEGRATED FLOW RATE = \$6.89 CU.FT/SEC = 7.005 LBM/SEC

AVERAGE VELOCITY = 121.33 FT/SEC

FRIMARY FLCW RATE, WP = 3.745 L8M/SEC

FRIMARY VELOCITY, UP = 217.56 FT/SEC

MCMENTUM FACTOR, KM = 1.027

(b) L/D = 2.5



CATA TAKEN ON 8 MARCH 1978 BY LEMKE AND STAEHLI S/C=.5; L/C= 2.5 STFAIGHT STACK; 4 NOZZLES(3.699 IN.)

AMEIENT PRESSURE = 29.979 IN.HGA, TEMPERATURE = 63.0 DEG.FAFR
PRIMARY (UPTAKE) TEMPERATURE = 106.4 DEG.FAFR

) INC	R FES	PTA In.	P T B	VA FT/	SEC	VA/VAV	VB/VAV	VA/UF	V 8/UP
0.0	5.875	2.10	1.05	98.4	69.6	C.8643	0.6111	0.5490	0.3882
(.500	5.275	3.CO	1.45	117.7	81.8	1.0330	0.7182	0.6561	0.4562
1.000	4.875	3.30	1.65	123.4	87.3	1.0834	C.7661	C.6882	0.4866
1.5CC	4.275	4.25	1.85	140.1	92.4	1.2295	0.8112	0.7810	0.5153
2.00C	3.875	5.00	2.25	151.9	101.9	1.3336	0.8946	C. E471	0.5682
2.500	2.375	4.55	2.70	151.2	111.6	1.3269	0.9800	0.8428	0.6225
3.CCC	2.875	4.85	2.90	145.6	115.7	1.3134	1.0156	0.8343	0.6451
3.5CC	2.375	4.40	3.35	142.5	124.3	1.2510	1.0916	0.7546	0.6934
4.000	1.875	4 • 2 C	3.60	135.2	128.5	1.2223	1.1316	0.7764	0.7188
4.5CC	1.375	3.80	3.65	132.4	129.8	1.1626	1.1354	0.7285	C.7257
5.00C	C.875	3.60	3.55	128.5	128.0	1.1316	1.1237	0.7188	C.7138
5.500	C.375	3.45	3.50	126.2	127.1	1.1078	1.1158	0.7036	0.7087
6.000	0.125	3.50	3.55	127.1	128.0	1.1158	1.1227	0.7087	C.7138
6.50C	0.625	3.65	3 • £ C	125.8	128.5	1.1394	1.1316	0.7237	0.7188
7.000	1.125	3.85	3.7C	133.3	130.7	1.1702	1.1472	0.7433	0.7287
7.500	1.625	4-05	3.55	136.7	128.0	1.2002	1.1237	0.7624	0.7138
E.00C	2.125	4 • 45	3.35	143.3	124.3	1.2581	1.0516	0.7951	0.6934
€.50C	2.625	4.55	2.85	151.2	114.7	1.3269	1.0068	0.8428	0.6395
5.000	3.125	5.05	2.40	152.7	105.2	1.3493	0.5235	0.8513	0.5869
9.5CC	3.625	5.10	2.00	153.4	96.1	1.3469	0.8434	0.8555	0.5357
16.666	4.125	4.20	1.75	135.2	89.5	1.2223	C.789C	0.7764	0.5011
10.500	4.625	3.55	1.55	128.0	84.6	1.1237	0.7425	0.7138	0.4716
11.000	5.125	2.80	1.45	113.7	81.8	C.9980	0.7182	0.6339	0.4562
11.500	5.625	1.45	1.10	81.8	71.3	0.7182	0.6255	0.4562	0.3973
11.75C	5.875	1.45	1.10	81.8	71.3	0.7182	0.6255	0.4562	0.3973

INTEGRATED FLCW RATE = 85.78 CU.FT/SEC = 6.220 LBM/SEC

AVERAGE VELCCITY = 113.91 FT/SEC

PRIMARY FLOW RATE, WP = 3.759 LBM/SEC
PFIMARY VELOCITY, UF = 179.34 FT/SEC

MOMENTUM FACTOR, KM = 1.038

(a) L/D = 2.5

TABLE XV. EXIT VELOCITY DATA FOR STRAIGHT MIXING STACK WITH 3.70 IN. NOZZLES



CATA TAKEN (N S MARCH 1978 EY LEMKE AND STAEHLI S/C=.5; L/C= 1.75 STRAJGHT STACK; 4 NOZZLES(3.699 IN.)

AMEIENT PRESSURE = 29.854 IN.HGA, TEMPERATURE = 66.0 DEG.FAFR
FFIMARY (UPTAKE) TEMPERATURE = 110.6 DEG.FAFR

X	R ⊁ES	P TA IN . I	P T B -20	VA FT/	SEC VB	VAVVAV	VB/VAV	VA/LF	V 8/U P
0.0	5.875	1.20	0.50	74.8	48.2	C.6857	C.4426	0.4138	0.2671
(.50C	5.375	2.25	C.65	102.5	55.1	0.5350	0.5647	0.5666	0.3045
1.000	4.875	3.30	1.00	124.1	68.3	1.1372	0.6260	C.6861	0.3777
1.50C	4.375	4.40	1.05	143.3	70.0	1.3131	0.6415	0.7523	0.3870
2.000	2.875	5.40	1.50	158.7	83.7	1.4547	0.7667	0.8777	0.4626
2.50C	3.375	5.70	2.10	162.1	59.0	1.4945	0.5072	0.5018	0.5473
3.00C	2.875	5.7C	2.60	163.1	110.1	1.4945	1.0094	0.5018	0.6050
3.5CC	2.375	5.35	3.30	158.0	124.1	1.4479	1.1272	0.8736	0.6861
4.000	1.875	4.75	3.65	148.9	130-5	1.3643	1.1560	0.8232	0.7216
4.50C	1.375	4.C5	3.75	137.5	132.3	1.2598	1.2122	0.7601	0.7314
5.00C	C.875	3.60	3.65	125.4	130.5	1.1877	1.1560	0.7166	0.721€
5.500	C.275	3.20	3.30	122.2	124.1	1.1198	1.1372	0.6757	0.6861
6.CCC	C.125	3.20	3.15	122-2	121.2	1.1198	1.1110	0.6757	0.6764
6.5CQ	0.625	3.30	3.35	124.1	125.0	1.1372	1.1458	0.6861	0.6513
7.000	1.125	3.60	3.55	129.6	128.7	1.1877	1.1795	0.7166	0.7117
7.500	1.625	3 •95	3.70	135.8	131.4	1.2441	1.2041	C.75C7	0.7265
8.000	2.125	4 • 60	3.35	146.5	125.0	1.3426	1.1458	0.8101	0.6913
ۥ5CC	2.625	5.45	2.75	159.5	113.3	1.4614	1.0381	0.8818	0.6264
9.000	3.125	5.90	2 .4C	165.9	105.8	1.5205	3:32.0	0.9174	0.5851
9.50C	3.625	5.60	1 • E C	161.6	91.6	1.4814	(.8359	0.8938	0.5067
10.000	4.125	4.60	1.20	146.5	74.8	1.3426	0.6857	C. E1C1	0.4138
10.500	4.625	3.45	1.05	126.9	70.0	1.1627	0.6415	0.7016	3.3870
11.CCC	5.125	2.40	0.50	105.8	64.8	0.9698	0.5939	.0.5851	C.3583
11.500	5.625	1.60	0.65	86.4	55.1	0.7918	0.5047	0.4778	0.3045
11.75C	5.875	1.60	0.65	86 • .4	55.1	C. 7918	0.5047	9.4778	0.3045

INTEGRATED FLC+ RATE = 82.17 CU.FT/SEC = 5.854 LBM/SEC

AVERAGE VELOCITY = 105.12 FT/SEC
PRIMARY FLOW RATE; WP = 3.747 LBM/SEC
FFIMARY VELOCITY, UP = 180.85 FT/SEC
MCMENILM FACTOR, KM = 1.078

(b) L/D = 1.75



CATA TAKEN CN 13 MARCH 1978 EY LEMKE AND STASHLI \$/D=.5; L/C= 2.5; 7 DEGREE SCLID DIFFLSOR 4 NOZZLES(3.695 IN.)

AMEIENT PRESSURE = 30.166 I N.HGA, TEMPERATURE = 72.0 DEG.FAFR

PFIMAFY (LPTAKE) TEMPERATURE = 111.2 DEG.FAFR

X IVC	HES	PTA 1N•1	PTE +20	VA FT/	'SEC ^{VB}	VAVVAV	VB/VAV	VA/LF	VB/LF
0.0	6.375	1.20	0.25	74.6	40.3	C.7207	0.3892	0.4146	0.2235
(.500	5.875	2.25	0.70	102.2	57.0	0:9869	0.5504	0.5677	0.3166
1.000	5.375	3.00	0.75	118.0	59.0	1.1395	0.5698	C.6555	0.3277
1.500	4.875	3.60	1.13	129.3	71. 5	1.2483	0.65((0.7181	J.3969
2. CCC	4.375	4.50	1.40	144.5	80.6	1.3956	0.7784	0.8028	0.4478
2.500	3.875	4.85	1.85	150.0	92.7	1.4489	0.8948	C.8324	0.5147
3.000	3.275	4.50	2.15	150.8	99.9	1.4563	0.9647	0.8377	0.5549
3.5CC	2.875	4.80	2.65	149.3	110.9	1.4414	1.0710	0.8291	0.6161
4.000	2.375	4.50	3.10	144.5	120.0	1.3956	1.1584	0.8028	0.6663
4.5CC	1.875	4.25	3.45	140.5	126.6	1.3563	1.2220	0.7802	0.7029
5.000	1.275	3.90	3.50	134.6	127.5	1.2993	1.2208	C.7474	0.7080
5.500	0.875	3.55	3.45	128.4	126.6	1.2396	1.2220	C.7131	0.7029
€.CCC	C.275	3.30	3.25	123.8	122.8	1.1951	1.1861	0.6875	0.6823
6.500	C.125	3.20	3.20	121.5	121.5	1.1769	1.1769	C.677C	0.677C
7.000	C.625	3.20	3.20	121.5	121.9	1.1769	1.1769	0.6770	0.6770
7.500	1.125	3.40	3.40	125.6	125.€	1.2131	1.2131	0.6978	0.6978
0.000	1.625	3.65	3.25	130.2	122.8	1.2569	1.1861	0.7230	0.6823
8.500	2.125	4.CC	3.CO	136.3	118.0	3158	1.1395	0.7569	0.6555
9.000	2.625	4.60	2.65	146.1	110.9	1.4110	1.0710	0.8117	0.6161
9.500	3.125	4.85	2.30	15 C. C	103.3	1.4489	C.5578	0.8334	0.5739
16.660	1.625	5.20	1.75	155.4	90.1	1.5003	0.8703	0.8630	0.5006
10.500	4.125	5.00	1.45	152.4	82.0	1.4711	0.7922	0.8462	0.4557
11.000	4.625	4.10	1.10	138.0	71.5	1.3322	0.6900	0.7663	0.3969
11.500	5.125	3.30	0.80	123.8	60.9	1.1951	0. 5884	0.6875	0.33 85
12.000	5.625	2.35	C-60	104.4	52.8	1.3085	0.5096	0.5802	0.2931
12.500	6.125	1.60	0.30	86.2	37.3	0.8322	C.36C3	0.4787	0.2073
12.750									

INTEGRATED FLOW RATE = 91.82 CU.FT/SEC = 6.621 LBM/SEC

AVERAGE VELCCITY = 103.56 FT/SEC

PFIMARY FLOW RATE, WP = 3.765 LB M/SEC

PFIMARY VELCCITY, LP = 180.03 FT/SEC

MCMENTUM FACTOR, KM = 1.083

(a) 7 DEGREE SOLID DIFFUSOR, RUN 1

TABLE XVI. MIXING STACK EXIT VELOCITY DATA FOR VARIOUS EXIT GEOMETRIES



DATA TAKEN ON 14 MARCH 1978 BY LEMKE AND STAEHLI S/C=.5; L/C= 2.5; 7 DEGREE SOLID DIFFUSOR 4 NCZZLES(3.655 IN.)

AMEIENT PRESSURE = 30.136 IN.HGA, TEMPERATURE = 85.0 DEG.FAHR PRIMARY (UPTAKE) TEMPERATURE = 116.5 CEG.FAFR

X	R	PTA IN.H	PTE	VA FT/	'SEC VB	VAVVAV	VAV\8V	VA/LP	V8/UP
C.O	6.375	C.75	0.05	59.5	15.4	0.5997	0.1548	0.3251	0. C 85 0 -
0.500	5.875	1.50	0.25	84.1	34.3	C: 8481	C.3462	0.4654	0.1900
1.COO	5.375	2.20	0.40	101.9	43.4	1.0271	C.43EC	0.5636	0.2403
1.500	4.875	3.00	0.80	119.0	61.4	1.1994	C.6194	0.6581	0.3399
2.000	4.375	3.60	1.10	130.3	72.0	1.3139	0.7263	0.7209	0.3985
2.500	3.875	4.20	1.30	140.8	78.3	1.4152	C.7896	0.7787	0.4332
3.00C	3.375	4.80	1.80	150.5	92.2	1.5172	0.5251	0.8325	0.5098
3.50C	2.875	4.90	2.20	152.1	101.9	1.5329	1.0271	0.8411	0.5636
4.0CC	2.375	4.30	2.70	142-4	112.9	1.4360	1.1379	0.7879	0.6244
4.500	1.875	4.40	3.10	144.1	120.5	1.4526	1.2193	0.7970	0.6690
5.000	1.375	4.05	3.50	138.2	128.5	1.3936	1.2955	0.7647	C. 71CS
5.5CC	C.875	3.55	3.25	129.4	123.8	1.3048	1.2484	0.7159	0.6850
6.000	0.375	3.25	3.20	123.8	122.9	1.2484	1.2388	0.6850	0.6797
6.500	0.125	3.20	3.15	122.9	121.9	1.2388	1.2290	0.6797	C.6744
7.000	0.625	3.15	3.30	121.9	124.8	1.2290	1.2580	0.6744	0.6502
7.50C	1.125	3.25	3.40	123.8	126.7	1.2484	1.2769	0.6850	0.7006
8.000	1.625	3.45	3.30	127.6	124.8	1.2862	1.2580	0.7058	0.6902
8.500	2.125	3.80	3.35	133.9	125.7	1-3499	1.2675	0.7407	0.6955
5.00C	2.625	4.25	2.75	141.6	113.9	1.4276	1.1484	0.7813	0.6301
9.500	3.125	4.95	2.4C	152.8	106.4	1.5407	1.0728	0.8454	0.5886
1 C. 00 C	3.625	5.25	2 • CC	157.4	97 • 1	1.5867	0.9793	0.8706	0.5374
1C.5CC	4.125	5.00	1.45	153.6	82.7	1.5485	0.8339	C. 8496	0.4575
11.000	4.625	4.10	1.20	135.1	75 - 2	1.4022	0.7586	0.7694	0.4162
11.500	5.125	3.30	0.50	124.8	65.2	1.2580	0.6570	0.6902	C.36C5
12.000	5.625	2.40	0.50	106.4	48-6	1.0728	0.4857	0.5886	0.2687
12.5CC	6.125	1.75	0.25	90.9	34.3	C.9161	0.3462	0.5027	0.1900
12.750	6.375	1.25	0.20	76.8	30 • 7	C.7742	0.3097	0.4248	0.1699

INTEGRATED FLOW RATE = 87.95 CU.FT/SEC = 6.239 L8M/SEC

AVERAGE VELOCITY = \$9.20 FT/SEC

PFIMARY FLCW RATE, WP = 3.743 L8M/SEC

PFIMARY VELOCITY, UP = 180.78 FT/SEC

PCMENTUM FACTOR, KM = 1.108

(b) 7 DEGREE SOLID DIFFUSOR, RUN 2



AMEIENT PRESSURE = 30.140 1N. HGA, TEMPERATURE = 86.0 DEG. FAFR PRIMARY (UPTAKE) TEMPERATURE = 113.1 DEG. FAHR

XINC	⊦ES ^R	PTA IN . I	PTE 120	VA FT/	SEC V8	VA/VAV	V4V\8V	VA/LP	V8/UP
C.O	6.250	1.30	0.40	78.2	43.4	0.7843	0.4350	0.4336	C. 2405
C.5CC	5.75C	2.40	9.70	106.3	57.4	1.0656	0.5755	0.5892	0.3182
1.000	5.25C	2.80	0.90	114.8	65.1	1.1510	0.6526	0.6364	0.3608
1.500	4.75C	3.50	1.20	135.5	75.1	1.3584	0.7535	0.7510	C.4166
2.CCC	4.250	4.20	1.70	140.6	89.4	1.4097	0.8569	0.7794	0.4959
2.500	3.75C	4.7C	2.10	148.7	99.4	1.4913	0.9568	0.8245	0.5511
E. 000	3.25 C	4.70	2.50	148.7	108.5	1.4913	1.0876	0.8245	0.6013
3.500	2.750	4.60	2.90	147.1	116.8	1.4753	1.1714	0.8157	0.6476
4.000	2.250	4.40	3.4C	143.9	126.5	1.4429	1.2684	0.7977	0.7012
4.500	1.750	4.10	3.50	138.9	128.3	1.3928	1. 2869	C. 77Cl	0.7115
5.CCC	1.250	3.70	3.50	131.9	128 3	1.3231	1.2869	0.7315	0.7115
5.5 C 0	C.750	3.50	3.25	128.3	123.7	1.2869	1.2401	0.7115	0.6856
6.CCC	C.250	3.30	3.10	124.6	120.8	1. 2496	1.2111	0.6909	0.6696
6.5CC	C.25C	3.30	3.05	124.6	119.8	1.2496	1.2013	0.6909	0.6642
7.0CC	C.75C	3.40	3.20	126.5	122.7	1.2684	1.2305	C.7C12	0.6803
7.500	1.250	3.60	3.25	130.1	123.7	1.3051	1.2401	0.7216	J.6856
8.00C	1.75C	3.90	3.40	135.5	126.5	1.3584	1.2684	0.7516	0.7012
8.500	2.25C	4.40	3.20	143.9	122.7	1.4429	1.2305	0.7977	0.6863
9.00C	2.75C	4 • S C	2.50	151.8	116.8	1.5227	1.1714	0.8418	J.6476
5.500	3.25C	5.10	2.40	154.9	106.3	1. 5534	1. C656	0.8588	0.5852
10.000	1.750	5.10	2.00	154.5	57.0	1.5534	0.9728	0.8588	375.0
10.500	4.250	4.3C	1.70	142.2	89.4	1.4264	0.8969	0.7886	0.4959
11.000	4.750	3.00	1.40	118.8	81 • 2	1.1914	0.8139	0.6587	C.45CC
11.500	5.250	2.30	1.20	104.0	75.1	1.0432	0.7535	0.5768	0.4166
12.000	5.75C	2.00	0.80	97.0	61.4	C.9728	0.6152	0.5378	C.3402
12.500	6.250	0.90	0 • 4 C	65.1	43. 4	0.6526	0.435C	0.3608	0.2405

INTEGRATED FLOW RATE = 84.98 CU.FT/SEC = 6.045 L8M/SEC

AVERACE VELOCITY = 99.72 FT/SEC

PFIMARY FLCW RATE, WP = 3.757 L8M/SEC

PFIMARY VELOCITY, LP = 180.36 FT/SEC

MCMENTUM FACTOR, KM = 1.150

(c) 7 DEGREE SOLID DIFFUSOR, RUN 3



DATA TAKEN CN 27 APRIL 1978 BY LEMKE AND STAEHLI S/C=.5; L/C= 2.5; 7 DEGREE SOLID CIFFUSOR RING; 4 NOZZLES(3.699 IN.) SECONDARY BCX CLCSEC; TERTIARY BCX CFEN

AMBIENT PRESSURE = 30.069 IN.HGA, TEMPERATURE = 71.0 DEG.FAFR FFIMARY (LPTAKE) TEMPERATURE = 106.6 DEG.FAFR

X INC	FESR	PTA In.H	PT8	VA FT/	'SEC ^{VB}	VA/VAV	VB/VAV	VA/LF	V8/LF
C.0	6.250	1.60	0.30	86.1	37.3	C.9100	0.3940	0.4753	0.2075
G.500	5.750	2.70	0.50	111.8	48.1	1.1821	0.5087	0.6226	0.2675
1.0CC	5.25C	3.20	0.80	121.7	60.9	1.2869	0.6434	0.6778	9356.0
1.500	4.750	3.70	C.5C	130.9	64.6	1.3838	0.6825	0.7289	0.3595
2.000	4.250	4 • C5	1.20	137.0	74.5	1.4477	0.7880	0.7626	0.4151
2.500	3.750	4.00	1.60	136.1	86.1	1.4388	0.5100	0.7578	0.4793
3.300	3.250	4.25	2.10	140.3	98.6	1.4830	1.0425	C. 7812	0.5491
3.50C	2.75C	3.80	2.70	132.7	111.8	1.4023	1.1821	0.7386	3.6226
4.CCC	2.25C	3.75	3.20	131.8	121.7	1.3931	1.2869	C.7338	0.6778
4.500	1.750	3.55	3.50	128.2	127.3	1. 35 54	1.3458	0.7139	0.7089
5.CCC	1.250	3.45	3.45	126.4	126.4	1.3362	1.3362	0.7028	C.7C38
5.5CC	(.75C	3.25	3.40	122.7	125.5	1.2969	1.3265	C.6831	0.6987
6.0CC	C.25C	3.25	3.20	122.7	121.7	1.2969	1.2869	0.6831	0.6778
6.5CO	C.25C	3.25	3.15	122.7	120.8	1.2969	1.2768	0.6831	C.6725
7.000	0.750	3.25	3.30	122.7	123.€	1.2969	1.3068	0.6831	6330.0
7.50C	I.25C	3.4C	3.40	125.5	125.5	1.3265	1.3265	0.6987	0.6987
8.000	1.750	3.70	3 - 45	130.9	126.4	1.3838	1.3362	0.7289	0.7038
9.500	2.250	4 • 2 0	3.30	139.5	123.6	:.4743	1.3068	0.7765	3.6883
9.000	2.75C	4.55	3.05	145.2	118.9	1.5345	1.2563	0.8083	0.6617
9.500	3.250	4.60	2.50	146.0	107.6	1.5429	1.1374	0.8127	0.5991
16.000	3.75C	4.20	2.05	13 9.5	97 • 4	1.4743	1.0300	0.7765	0.5425
10.500	4.250	3.45	1.6C	126.4	86.1	1.3362	0.9100	C.7038	0.4793
11.000	4.750	2.60	1.30	109.7	77.6	1.1600	3.82 (2	0.6110	0.4320
11.500	5.250	2.30	1.00	103.2	68.1	1.0910	0.7194	0.5747	0.3789
12.000	5.750	1.60	0.65	86.1	54.9	0.9100	0.5800	0.4793	0.3055
12.5CC	6.250	1.CC	0.35	68.1	40 • 3	C.7194	0.4256	0.3789	0.2242

INTEGRATED FLCW RATE = 80.62 CU.FT/SEC = 5.826 LBM/SEC

AVEFAGE VELOCITY = \$4.60 FT/SEC
PRIMARY FLOW RATE, WP = 3.775 L8M/SEC
FFIMARY VELCCITY, UP = 175.60 FT/SEC
MCMENTUM FACTOR, KM = 1.154

(d) 7 DEGREE SOLID DIFFUSOR, RUN 4 TABLE XVI (CONTINUED)



DATA TAKEN ON 11 MAY 1978 BY LEMKE AND STAEHLI S/C=.5; L/O= 2.5; ThO SCLIC DIFFUSOR RINGS; 4 NOZZLES(3.695 IN.) SECCNOARY ECX CPEN; TEFTIARY BCX OPEN

AFEIENT FRESSLIFE = 30.128 IN.HGA, TEMPERATURE = 76.0 DEC.FAFR
PRIMARY (UPTAKE) TEMPERATURE = 111.5 OEG.FAHR

X INC	FE S	PTA IN • I	PT8 -20	VA F T/	SEC VB	VA/VAV	VB/VAV	VA/LP	VE/UP
0.0	7.CC0	0.30	0.01	37.4	6 •8	0.4567	0.0834	0.2078	C. C379
C.5CC	6.50C	0.55	0.15	50 • • 6	26.4	0.6184	0.3229	C.2814	0.1469
1.000	6.CCC	1.40	0.35	80.8	40.4	C. 9866	0.4933	0.4489	0.2245
1.500	5.500	2.75	0.75	113.2	59.1	1.3827	0.7221	0.6292	C.3286
2.000	5.00C	3.55	1.40	128.7	80.€	1.5710	0.9866	0.7149	0.4489
2.50C	4.50C	4.10	1.85	138.3	92.9	1.6883	1.1341	0.7683	0.5161
3.000	4.000	4 • 40	2.(5	143.3	97.8	1.7450	1.1538	0.7959	0.5432
3.500	2.500	4.20	2.70	140.0	112.2	1.7088	1.3701	0.7776	0.6234
4.000	3.000	4 • 00	2.85	136.6	115.3	1.6676	1.4076	0.7588	0.6405
4.500	2.500	3.90	3 .2C	134.9	122.2	1.6466	1.4916	0.7493	0.6787
5. CCC	2. COC	3.65	3 •3 C	13 C•5	124.1	1.5930	1.5147	0.7249	0.6892
5.500	1.500	3.40	3.25	125.9	123.1	1.5375	1.5032	C.6956	0.6840
6.CCC	1.000	3.25	3.20	123.1	122.2	1. 50 32	1.4916	0 .68 40	0.6787
6.5C0	C•500	3.10	3.15	120.2	121.2	1.4681	1.4799	0.6680	C. 6734
7.000	C • 0	3.20	3.10	122.2	120-2	:.4916	1.4681	C.6787	0.6680
7.5CC	C.50C	3.15	3.15	121.2	121.2	1.4799	1.4799	0.6734	0.6734
8.000	1.000	3.25	3.30	123.1	124.1	1.5032	1.5147	0.6840	C.6892
8.500	1.506	3 - 40	3.35	125.9	125.0	1.5375	1.5261	0.6956	0.6944
9.0CC	2.00C	3.80	3.30	133.1	124.1	1.6254	1.5147	0.7356	0.6892
9.500	2-500	4.15	3.10	139.1	120 - 2	1.6986	1.4681	0.7729	0.6680
10.000	3.000	4.55	2.60	145.7	110.1	1.7786	1.3445	0.8093	3.6118
1C.50C	3.500	4 • 30	2.40	141.6	105.8	1.7290	1.2517	0.7868	0.5878
11.000	4.000	4 • 10	2.00	138.3	96.6	1.6883	1.1792	0.7683	0.5366
11. 5CC	4.5CC	3.20	1.50	122.2	33.6	1.4916	1.0212	0.6787	0.4647
12.000	5.000	2.30	1.05	103.6	70.0	1.2645	0.8544	C.5754	0.3888
12.500	5.50C	1.40	0.60	80.8	52.9	0.9866	0.6459	0.4489	0.2939
13.000	6.000	0.80	0.15	61.1	26 • 4	0.7458	0.3229	0.2394	C. 1465
13.500	6.50C	0.30	0.05	37.4	15.3	0.4567	0.1864	0.2078	0.0848
14.000	7.000	0.15	0.0	26.4	0.0	C.3229	0.0	0.1469	0.0

INTEGRATED FLCW RATE = 87.56 CU.FT/SEC = 6.284 LBM/SEC

AVERAGE VELOCITY = 81.50 FT/SEC

PRIMARY FLOW RATE, WP = 3.758 LBM/SEC

FFIMAFY VELOCITY, UP = 179.99 FT/SEC

MCMENTLM FACTOR, KM = 1.289

(e) TWO-RING DIFFUSOR



CATA TAKEN CN 14 JULY 1978 BY LEMKE AND STAEHLI 5/0=.5; L/0= 2.5; THREE SQLIC OIFFUSCE RINGS; 4 NOZZLES(3.699 IN.) SECONCARY ECX CPEN; TEFTIAFY BOX OPEN

AMBIENT PRESSURE = 25.969 IN.HGA, TEMPERATURE = 85.0 DEC.FAFR
FFIMARY (LPTAKE) TEMPERATURE = 114.5 DEG.FAFR

X	r FES	PTA In. F	PTE 2C	VA FT/	SEC	VA/VAV	VB/VAV	VA/LP	VB/UF
C. C	7.00C	0.20	0.02	30.8	9.7	0.3839	0.1214	0.1699	0.0537
(.5CC	6.50C	0.80	0.20	61.5	30.8	0.7679	0.3839	0.3355	C.1699
1.000	6.000	1.90	0.60	94.9	53.3	1.1834	0.6650	C.5238	0.2943
1.500	5.500	3.05	1.00	120.2	68 . 8	1.4953	0.8585	0.6636	0.3800
2. OCC	5.000	3.60	1.40	130.6	81.4	1.6289	1.0158	0.7210	0.4496
2.500	4.5CC	3.85	1.70	135.0	89.7	1.6845	1.1193	0.7456	0.4955
3.00C	4 •00 C	4 • CC	2.20	137.6	102.1	1.7170	1.2734	0.7600	0.5636
3.50C	3.500	3.90	2.70	135.9	113.1	1. 6954	1.4106	0.7504	C.6244
4.000	3.000	3 • 85	3.10	135.0	121.2	1.6845	1.5115	0.7456	0.6691
4.500	2.50C	3.75	3.50	133.3	128.7	1.6625	1.6061	0.7359	0.7109
5.000	2.000	3.60	3.40	130.6	126.9	1.6289	1.5830	0.7210	C.7CG7
5.5CC	1.500	3.50	3.4C	128.7	126.9	1.6061	1.5830	0.7109	0.7007
6.000	1.000	3.35	3.35	125.9	125.9	1.5713	1.5713	0.6955	C. 6955
6.5CC	0.500	3.20	3.15	123.1	122.1	1.5357	1.5237	0.6798	0.6744
7.000	0.0	3. 25	3.20	124.1	123.1	1.5477	1.5357	0.6850	0.6798
7.5CC	C.500	3.40	3.2C	126.9	125.0	1.5830	1.5595	C.7007	0.6903
200.3	1.000	3.60	3 • 40	130.6	126.9	1.6289	1.5830	9.7219	0.7007
8.5CC	1.5CC	3.90	3.35	135.9	125.9	1.6954	1.5713	0.7504	C.6955
5.0CC	2.000	4.35	3.20	143.5	123.1	1.7905	1.5357	0.7925	0.6758
5.5CC	2.50C	4.EC	2.60	150.8	111.0	1.8809	1.3843	0.8325	0.6127
10.000	1.CCC	5.CO	2.10	153.9	99.7	1.9196	1.2441	0.2457	0.5507
10.500	3.500	4-70	1.70	149.2	89.7	1.8612	1.1153	0.8238	0.4955
11.000	4.000	3.85	1.25	135.0	76.9	1.6845	0.5598	0.7456	0.4248
11.500	4.500	3.00	C.5C	115.2	65.3	1.4870	0. 8144	0.6582	C.36C5
12.000	5.000	1.80	0.50	92.3	48.7	1.1518	0.6070	0.5098	0.2687
12.500	5.500	1.10	0.20	72.2	30.8	0.9004	9836.0	0.3985	0.1699
13.000	6.00C	0.60	0.10	53.3	21.8	0.6650	C.2715	0.2943	0.1202
13.5CC	6.500	0.15	0.03	26.7	11.9	0.3325	C.1487	0.1472	C.0658
14.CCC	7.000	0.05	0.0	15.4	0.0	0.1920	0.0	0.0850	0.0

INTEGRATED FLOW RATE = 85.69 CU.FT/SEC = 6.057 LBM/SEC

AVERAGE VELOCITY = 80.16 FT/SEC

PFIMARY FLCW RATE, WP = 3.741 LEM/SEC

PFIMARY VELOCITY, UP = 181.09 FT/SEC

MCMENILM FACTOR, KM = 1.318

(f) THREE-RING DIFFUSOR



CATA TAKEN ON 7 AUGUST 1978 BY LEMKE AND STAEFLI \$/C = .5; L/C = 2.5 FORTEC MIXING STACK; 4 NC22LES (3.699 IN.); A-1 B-1 C-2 D-2 CONFIGERATION

AFBIENT PRESSURE = 29.954 IN.HGA, TEMPERATURE = 102.0 DEG.FAHR
PRIMARY (LPTAKE) TEMPERATURE = 132.8 DEG.FAHR

X	HES	P T # 1N .H	PTE 120	VA FT/	SEC VB	VA/V AV	V 8/V AV	VA/LP	V E / LP
C.O	5.875	1.90	1.30	96.4	79 .7	0.8077	C.6681	0.5248	0.4341
0.500	5.375	2.70	1.85	114.9	95.1	0.9629	0.7570	0.6256	0.5178
1.000	4.875	3.10	2.25	123.1	104.9	1.031 8	(.8790	0.6703	0.5711
1.500	4.375	3.70	2.55	134.5	111.6	1.1272	0.9358	0.7324	0.6080
2.000	3.875	3.75	2.50	135.4	119.1	1.1348	C. 9979	0.7373	0.6484
2. 5CC	2.375	3.80	3.35	136.3	128.0	1.1423	1.0726	0.7422	0.6969
3.000	2.875	3.60	3.85	132.6	137.2	1.1119	1.1458	0.7224	0.7470
3:50C	2.375	3.50	4.05	130.8	140.7	1.0963	1.1793	9.7123	0.7662
4.000	1.875	3.35	3.95	128.0	138.9	1.0726	1.1646	0.6969	C.7567
4.5CC	1.375	3.10	3.60	123.1	132.6	1.0318	1.1119	0.6703	0.7224
5.000	2.8.0	3.10	3.45	123.1	129.9	1.0318	1.0884	0.6703	0.7072
5.500	0.375	3.10	3.15	123.1	124.1	1.0318	1. C4CC	0.67C3	0.6757
6.000	0.125	3.20	3.15	125.1	124 - 1	1.04 83	1.0400	0.6811	0.6757
6.500	0.625	3.40	3.25	128.9	128.0	1.0805	1.0726	0.7020	0.6565
7.000	1.125	3.60	3.7C	132.6	134.5	1.1119	1.1272	0.7224	0.7324
7.500	1.625	3.50	3. SC	138.1	138.1	1.1573	1.1573	0.7519	0.7519
8.00G	2.125	4.15	3.90	142.4	138.1	1.1938	1.1573	C.7756	0.7519
E. 5CC	2.625	4.40	3 .65	146.6	133.6	1.2292	1.11 55	0.7986	0.7274
5.COC	3.125	4.30	3.4C	145 .C	128.9	1.2152	1.0805	0.7895	C.7C20
9.5CC	3.625	4.00	2.70	135.8	114.9	1.1720	0.5625	C.7615	0.6256
10.000	4.125	3.30	2.60	127.0	112.7	1.0645	0.9449	0.6916	0.6135
10.500	4.625	2.70	2.60	114.9	112.7	0.9629	0.9449	0.6256	0.6139
11.000	5.125	2.20	2 • 2 C	10 3.7	103.7	C. 86 92	0.8652	0.5647	0.5647
11.50C	5.625	1.65	1.80	89.8	93.8	0.7527	0.7862	0.4891	0.5108
11.750	5.875	1.50	1.30	85.6	79 • 7	0.7177	0.6681	0.4663	0.4341

INTEGRATED FLOW RATE = 89.83 CU.FT/SEC = 6.152 L6M/SEC

AVERAGE VELOCITY = 119.30 FT/SEC FFIMARY FLCW RATE, WP = 3.674 L8M/SEC FFIMARY VELOCITY, UP = 183.62 FT/SEC

PCMENTUM FACTOR, KM = 1.019

TABLE XVII. EXIT VELOCITY DATA FOR STRAIGHT PORTED MIXING STACK



CATA TAKEN ON 16 AUGUST 1978 BY LEMKE AND STABHLI S/C = .5; L/D = 2.5, TWC SCLID DIFFUSCR RINGS FCFTED MIXING STACK; 4 NOZZLES (3.699 IN.); A-1 8-1 C-2 D-2 CONFIGURATION

AMBIENT PRESSURE = 29.978 IN.HGA, TEMPERATURE = 68.0 OEG.FAFR
PFIMARY (LFTAKE) TEMPERATURE = 112.0 DEG.FAFR

X 1NC	R ⊦ES	FTA IN. I	PTE -20	۷ <u>۸</u> ۴۲/	SEC VB	VA/VAV	VB/VAV	VA/LP	V8/UP
C.O	7.000	0.15	0.02	26.4	9.7	0.3434	0.1254	0.1462	C.0534
C.5CC	6.50C	0.40	0.04	43.2	13.7	0.5608	0.1774	C.23 E7	0.0755
1.000	6.CCC	1.20	0.28	74.8	36.1	0.9714	0.4692	0.4134	0.1957
1.50C	5.500	1.50	0.65	94.1	55.0	1.2223	0.7149	0.52(2	C.3043
2.000	5.000	2.80	0.85	114.2	62.5	1.4838	0.8176	0.6315	0.3480
2.500	4.50C	3.90	1.20	134.8	74.8	1.7512	0.9714	0.7453	0.4134
3.000	4.00C	4.50	1.60	144.8	86 •4	1.8811	1. 1217	C. EOC 6	0.4774
3.500	3.500	4.70	2.10	148.0	98.9	1.9225	1.2850	0.8182	0.5469
4.000	3.COC	4.6C	2.50	146.4	107.9	1.9019	1.4021	0.8095	0.5968
4.500	2.500	4.30	3.00	141.6	118.2	1.8388	1.5359	0.7826	0.6537
5.000	2.000	4.15	3 • 40	139.1	125.9	1.8065	1 -6351	0.7689	0.6959
5.500	1.50C	3.90	3.6C	134.8	129.5	1.7512	1.6825	0.7453	0.7161
6.CCC	1.000	3.65	3.65	13 C. 4	130.4	1.6942	1.6542	0.7211	0.7211
6.500	0.500	3.45	3.50	126.8	127.7	1.6471	1.6590	0.7010	0.7661
7.000	0.0	3.40	3.45	125.9	126.8	1.6351	1.6471	C.6959	0.7010
7.50C	C.5CC	3.45	3.53	126.8	128.3	1.6471	1.6661	0.7013	0.7091
5.00C	1.000	3.65	3.70	130.4	131.3	1.6942	1.7057	0.7211	0.726C
8.500	1.500	4.05	3.70	137.4	131.3	1.7846	1.7057	0.7555	0.726C
5.00C	2.00C	4.5C	3.40	144.8	125.9	1.8811	1.6351	0.8006	0.6959
9.500	2.500	4.95	2.95	151.9	117.3	1. 9729	1. 5221	0. 83 57	C.6482
10.000	3.000	5.05	2.5C	153.4	107.9	1.9928	1.4021	0.8481	0.5968
1C.500	E. 500	4.7C	2.00	148.0	96.5	1.9225	1.2541	C. 8182	0.5337
11.000	4.000	3.70	1.€€	131.3	86 • 4	1.7057	1.1217	0.7260	0.4774
11.5CC	4.500	2.80	1.25	114.2	76.3	1.4838	0.9914	0.6315	0.4220
12.000	5.000	1.80	0.80	91.6	61.1	1.1897	0.7931	C.5064	0.3376
12.500	5.50C	1.00	0.40	68.3	43.2	0.8868	C.56(8	0.3774	0.2387
13.COC	6.00C	0.40	0.20	43.2	30.5	0.5608	0.3966	0.23 87	C.1688
13.5CC	6.50C	0.20	0.03	30.5	11.8	0.3966	0.1536	0.1688	0.0654
14.000	7.COC	0.15	0.0	26.4	0.0	0.3434	0.0	0.1462	0.0

INTEGRATEO FLOW RATE = 82.30 CU.FT/SEC = 5.910 LBM/SEC

AVERAGE VELOCITY = 76.99 F1/SEC

PRIMARY FLOW RATE, WP = 3.754 L8M/SEC

PRIMARY VELOCITY, UF = 180.88 FT/SEC

MCMENTLM FACTOR, KM = 1.355

TABLE XVIII. EXIT VELOCITY DATA FOR STRAIGHT PORTED MIXING STACK WITH A TWO-RING DIFFUSOR



CATA TAKEN ON 23 AUGUST 1576 BY LEMKE AND STAEHLI S/O = .5; L/D = 2.5, TWO SCLID OIFFUSCR RINGS AND SHROUD PORTED MIXING STACK; 4 NOZZLES (3.699 IN.); A-1 B-1 C-2 O-2 CONFIGURATION

AMBIENT PRESSURE = 29.980 1N.HGA, TEMPERATURE = 88.0 DEG.FAFR FRIMARY (LPTAKE) TEMPERATURE = 124.0 OEG.FAHR

× 1 N C	R SHES	PTA In.i	PTB -2C	VA FT/	SEC	VA/VAV	VB/VAV	VA/LP	VB/UF
0.0	7.000	0.25	0.02	34.6	9.8	0.4131	0.1168	0.1900	0.0537
(. 5((6.500	C.70	C .1 C	5 7.9	21.9	0.6913	0.2613	0.3179	0.1202
1.000	6.000	1.70	0.40	90.2	43.8	1.0773	0.5226	C.4955	0.2403
1.500	5.500	2.80	0.80	115.8	61.9	1. 2826	C.735C	0.6359	0.3399
2• CCC	5. CCC	3.70	1.20	133.1	75.8	1.5893	0.9051	0.7310	0.4163
2.500	4.500	4.10	1.60	140.1	87.5	1.6730	1.0451	0.7695	0.4807
3.00C	4.000	4.30	2.20	143.5	102.7	1.7133	1.2255	0.7880	0.5636
3.500	3 .5 C C	4 • 45	2.60	146.0	111.6	1.7430	i.3323	0.8616	0.6127
4.000	3.000	4.30	3.20	143.5	123.8	1.7133	1.4780	0.7880	0.6758
4.5CC	2.50C	4.10	3.45	140.1	128.6	1.6730	1.5347	3.7695	3.7058
5.000	2.000	3.85	3.6C	135.8	131.3	1.6212	1.5677	C.7456	0.7210
5.500	1.500	3.65	3.65	132.2	132.2	1.5785	1.5785	0.7260	0.7260
6. CCC	1.000	3.48	3.55	129.1	130.4	1.5413	1.5568	0.7089	0.7160
6.500	0.500	2.30	3.30	125.7	125.7	1.5009	1.5((9	0.6903	0.6903
7.CCC	C • C	3 • 30	3.25	125.7	124.8	1.5009	1.4895	0.6903	0.6851
7.500	C.500	3.35	3.35	126.7	126.7	1.5123	1.5123	C.6955	0.6955
8.0CC	1.000	3.55	3.50	130.4	129.5	1.5568	1.5458	0.7160	0.7109
ε• 5 ¢¢	1.5CC	3.90	3.7C	136.7	133.1	1.6317	1.5893	0.75(5	0.7310
5.0CC	2.000	4 • 25	3.90	142.7	136.7	1.7033	1.6317	C.7834	0.7505
9.50C	2.500	4.35	3.75	144.4	134.C	1.7233	1.6000	3.792€	0.7359
10.000	3.CCC	4.35	3.40	144.4	127.6	1.7233	1.5235	0.7926	(.7007
10.500	3.500	3.90	2.75	136.7	114.8	1.6317	1.3702	0.7505	0.6302
11.CCC	4.CCC	3.1C	2 • 2 C	121.9	102.7	1.4547	1.2255	0.6691	0.5636
11.500	4 •5 00	2.30	1.75	105.0	91.6	1.2531	1.0930	0.5763	0. 5027
12.000	5.000	1.60	1.20	87.5	75.8	1.0451	0.9051	0.4867	0.4163
12.500	5.530	0.82	0.86	62.7	61.9	C.7482	0.7350	- 0.3441	0.3399
13.000	6.000	0.55	0.35	51.3	40.5	0.6128	0.4888	0.2818	0.2248
13.500	6.5CC	0.20	0.15	31.0	26.8	0.3695	(.3200	0.1699	0.1472
13.990	7.000	0.05	0.03	15.5	12.0	0.1848	0.1431	0.0850	0.0658

INTEGRATED FLOW RATE = 89.42 CU.FT/SEC = 6.248 LBM/SEC

AVERAGE VELOCITY = 83.77 FT/SEC

PFIMARY FLOW RATE, WP = 3.703 LEM/SEC

FFIMARY VELOCITY, UP = 182.14 FT/SEC

MCMENTUM FACTOR, KM = 1.286

(a) SHROUD WITH A TWO-RING DIFFUSOR

TABLE XIX. EXIT VELOCITY DATA FOR A SHROUDED PORTED MIXING STACK WITH DIFFUSOR



CATA TAKEN ON 29 AUGUST BY LEMKE AND STAEFL1
\$/D = .5: L/D = 2.5, TWO SCLID DIFFUSOR RINGS AND SHROUD
FORTED MIXING STACK: 4 NOZZLES (3.699 IN.) : A-1 B-1 C-2 D-2 CONFIGURATION

AMBIENT PRESSLEE = 29.902 IN.HGA, TEMPERATURE = 80.0 DEG.FAFR
FF1MAFY (LPTAKE) TEMPERATURE = 114.0 DEG.FAFR

X 1NC	R ⊦ES	FTA IN.H	PTE -20	VA FT/	SECVB	VA /VA V	VE/VAV	VA/LF	VB/UF
C.C	7.000	0.25	0.05	34.4	15.4	0.4201	0.1879	0.1895	0.0847
(.500	6.500	0.65	0.10	55.4	21.7	0-6775	0.2657	0.3055	0.1198
1.000	6.000	1.60	0.12	87.0	23.8	1.0629	0.2511	C.4754	0.1313
1.500	5.500	2.90	0.40	117.1	43.5	1.4310	0.5314	0.6453	0.2397
2.000	5.000	3.80	0.80	134.C	61.5	1.6380	0.7516	0.73 87	0.3390
2.5((4.500	4.40	1.20	144.2	7 5 • 3	1.7626	0.9205	0.7949	0.4151
3.000	4.00C	4 • 4 C	1.45	144.2	82.8	1.7626	1.0118	0.7949	0.4563
3.50C	2.500	4.50	2.20	145.8	102.0	1. 7825	1.2464	0.8029	0.5621
4.000	3.000	4.35	2.65	143.4	111.9	1.7526	1.3679	0.7964	0.6165
4.500	2.500	4.15	3.10	140.0	121.0	1.7118	1.4795	0.7720	0.6672
5.000	2.000	3.95	3.50	136.6	128.6	1.6701	1.5720	0.7532	0.7056
5.500	1.500	3.75	3.85	133.1	134.9	1 • 62 72	1.6488	0.7339	0.7436
6.000	1.000	2.67	3.95	131.7	136.6	1-6398	1.6701	0.726G	0.7532
6.5CC	0.500	3.60	3.80	13C.4	134.0	1. 59 43	1,6386	0.7150	0.7387
7.000	0.0	3.70	3 • 65	132.2	131.3	1.6163	1.6054	0.7289	0.7240
7.500	C.500	3.80	3.65	134.0	131.3	1.6380	1.6054	C.7387	0.7240
8.000	1.000	4.10	3.65	139.2	131.3	1.7015	1.6054	0.7673	0.7240
8.500	1.500	4.35	3.80	143.4	134.0	1.7526	1.6380	0.75(4	C.7387
9.000	2.000	4.50	4.00	145.8	137.5	1.7825	1.6806	0.8039	0.7579
5.50C	2.50C	4.7C	3.95	149.0	126.6	1.8217	1.6701	0.8216	0.7532
10.000	3.000	4.40	3.76	144.2	133.3	1. 7626	1.6294	0.7945	C • 7348
10.500	3.500	3.65	3 • 35	131.3	125.8	1.6054	1.5380	0.7240	0.6936
11.000	4.000	2.85	2.55	116.1	118.1	1.4186	1.4433	0.6358	0.6505
11.500	4.500	1.80	2 • 25	92.2	103.1	1.1274	1. 2604	0. 50 84	0.5684
12.000	5.000	1.00	1.65	68.7	88.3	0.8403	1.0794	0.3790	0.4868
12.500	5.500	0.60	1.15	53.2	73 • 7	C•6509	0.9011	0.2935	0.4064
13.000	6.000	0 • 30	0.70	37.7	57.5	0.4602	0.7C3C	0.2076	0.3171
13.500	6.500	0.10	0.30	21.7	37.7	0.2657	0.4602	0.1158	0.2076
14.000	7.000	0.05	0.0	15.4	0.0	0.1879	0.0	0.0847	0.0

INTEGRATEO FLOW RATE = 87.45 CU.FT/SEC = 6.194 LBM/SEC

AVERAGE VELOCITY = 81.81 FT/SEC

PFIMARY FLOW RATE, WP = 3.742 L8M/SEC

PRIMARY VELOCITY, UP = 181.40 FT/SEC

MCMENTUM FACTOR, KM = 1.312

(b) SHORTENED SHROUD WITH TWO-RING DIFFUSOR



OATA TAKEN ON 25 AUGUST BY LEMKE AND STAEHLI S/C = .5; L/D = 2.5, FLOW THRU SHROUD AND DIFFUSOR RING FCFTEO MIXING STACK: 4 NOZZLES (3.695 IN.) : A-1 B-1 C-2 D-2 CONFIGURATION

AMEIENT PRESSURE = 29.902 IN.HGA, TEMPERATURE = 80.0 DEC.FAFR
PRIMARY (UFTAKE) TEMPERATURE = 114.0 DEG.FAHR

X INCHES		PTA PTE IN. F20		FT/SEC VB		VA/VAV	VB/VAV	VA/LP	Ve/up
C.C	7.000	C.25	C.15	34.4	26.6	C.4049	0.3136	0.1895	0.1468
C.50C	6.50C	0.65	C.55	55.4	51 • C	0.6529	0.6005	0.2055	C.281C
1.000	6.CCC	1.50	1.15	84.2	73.7	C. 9918	0.8684	0.4641	0.4064
1.5CC	5.5CC	Z.7C	1.35	113.0	79.9	1.3306	0.9409	0.6227	C.44(3
2.000	5.000	3.80	2.00	134.0	97.2	1.5785	1.1452	0.7387	0.5359
2.500	4.500	4.40	2.50	144.2	108.7	1.6986	1.2864	0.7949	0.5992
3.000	4.030	4 •55	2 •85	146.5	116.1	1.7273	1.3670	0.8084	0.6358
3.500	3.500	4.50	3.30	145.8	124.9	1.7178	1.4710	0.8039	0.6884
4.00 C	3.000	4.30	3.75	142.5	133.1	1.6792	1.5681	0.7858	0.7339
4.500	2.500	4.15	3.90	140.0	135.8	1.6496	1.5552	0.7720	0.7454
5. CCC	2.000	4.00	3 • 85	137.5	134.9	1.6195	1.5889	0.7579	0.7436
5.500	1.500	3.70	3.80	132.2	134.0	1.5576	1.5785	C.7289	0.7387
€.CCC	1.000	3.50	3.60	128. €	130.4	I. 51 49	1 .53 64	0.7090	0.7190
€.500	0.500	3.50	3.55	128.6	129.5	1.5149	1.5257	0.7090	C.714C
7.000	C.C	3.55	3.55	129.5	129.5	1.5257	1.5257	C.714C	0.714C
7.5C C	0.50C	3.65	3.70	13 I. E	132.2	1.5471	1.5576	0.7240	0.7289
8.000	1.000	3.85	4.10	134.9	139 • 2	1.5889	1.6396	0.7436	C.7673
8.500	I • 50 C	4.15	4.35	140.0	143.4	1.6496	1.6889	0.7720	0.7504
5.00C	2.00C	4.35	4 • 4 C	143.4	144.2	1.6889	1.6986	0.7964	0.7545
9.500	2.500	4 • 5 0	4.20	145.8	140.9	1.7178	1.6595	0.8039	0.7766
10.000	3.000	4.15	3.45	140.0	127.7	1.6496	1.5041	0.7720	0.7035
10.500	3.500	2.40	2.75	126.8	114.0	1.4931	1.3428	0.6988	0.6284
11.000	4.000	2.55	2 •25	109.8	103.1	1.2931	1.2146	0.6052	0.5684
11.5CC	4.50C	1.95	1.5C	96 • 0	84.2	1.1338	0.9918	0.5292	0.4641
12.000	5.00C	1.10	1.00	72.1	68.7	0.8493	0.8098	C.3975	0.3790
12.5CC	5.50C	0.70	0.55	57. 5	51. C	0.6775	0.60(5	0.3171	0.2810
13.COC	6.000	0.35	0.25	4C.7	34.4	0.4791	0.4049	0.2242	C. 1895
13.500	6.50C	0.10	0.05	21.7	15.4	0.2561	0.1 811	0.1198	0.0847
14.00C	7.COC	0.05	0.02	15.4	9.7	C.1811	0.1145	0.0847	0.0536

INTEGRATEO FLOW RATE = 90.75 CU.FT/SEC = 6.428 LBM/SEC

AVERAGE VELOCITY = E4.89 FT/SEC

PRIMARY FLOW RATE, WP = 3.742 LBM/SEC

FFIMARY VELOCITY, UP = 181.40 FT/SEC

MCMENILM FACTOR, KM = 1.299

(c) FLOW-THROUGH SHROUD WITH RING DIFFUSOR
TABLE XIX (CONTINUED)



APPENDIX A

FORMULAE

Presented here are the formulae used to obtain the primary and secondary mass flow rates. According to the ASME Power Test Code [5], the general equation for mass flow rate appearing in equation (a)

$$W(lbm/sec) = (0.12705) K A Y F_a [\rho \Delta P]^{0.5}$$
 (a)

may be used with flow nozzles and square edge orifices provided the flow is subsonic. In the above equation, K (dimensionless) represents the flow coefficient for the metering device and is defined as $K = C(1 - \beta^4)^{-0.5}$ where C is the coefficient of discharge and β is the ratio of throat to inlet diameters; $A(in^2)$ is the total cross sectional area of the metering device; Y (dimensionless) is the expansion factor for the flow; F_a (dimensionless) is the area thermal-expansion factor; ρ (lbm/ft 3) is the flow mass density; and ΔP (inches H_2O) is the differential pressure across the metering device. Each of these quantities are evaluated, according to the guidelines set forth in Reference [5], for the specific type of flow measuring device used.

Using a square edge orifice for measurement of the primary mass flow rate, the quantities in equation (a) are defined as follows:



- 1. The flow coefficient K is 0.62 based on a β of 0.502 and a constant coefficient of discharge over the range of flows considered of 0.60.
- 2. The orifice area is 37.4145 in^2 .
- Corresponding to the range of pressure ratios encountered across the orifice, the expansion factor Y is 0.98.
- 4. Since the temperature of the metered air is nearly ambient temperature, the thermal expansion factor is essentially 1.0.
- 5. The primary air mass density $\rho_{\mbox{or}}$ is calculated using the perfect gas relationship with pressure and temperature evaluated upstream of the orifice.

Substituting these values into equation (a) yields

$$W_{p}$$
 (lbm/sec) = (2.8882) $[\rho_{or} \Delta P_{or}]^{0.5}$ (b)

The secondary mass flow rate is measured using long radius flow nozzles for which case the quantities in equation (a) become:

- 1. For a flow nozzle installed in a plenum, β is approximately zero in which case the flow coefficient is approximately equal to the coefficient of discharge. For the range of secondary flows encountered, the flow coefficient becomes 0.98.
- A is the sum of the throat areas of the flow nozzles in use.



- 3. Since the pressure ratios across the flow nozzles are very close to unity, the expansion coefficient Y is 1.0.
- 4. Since the temperature of the metered air is nearly ambient temperature, the thermal expansion factor is essentially 1.0.
- 5. The secondary air mass density $\rho_{\rm S}$ is evaluated using the perfect gas relationship at ambient conditions. Substituting these values into equation (a) yields the equation for the secondary mass flow rate measured using long radius flow nozzles.

$$W_{s}$$
 (lbm/sec) = (0.13451) A $[\rho_{s} \Delta P_{s}]^{0.5}$ (c)



APPENDIX B

CALCULATION OF THE MOMENTUM CORRECTION FACTOR

The momentum correction factor is defined as the ratio of the actual momentum rate to the pseudo-rate based on the bulk-average velocity. Defining the actual momentum as that obtained by integrating over the velocity surface, the momentum correction factor may be written as

$$K_{m} = \frac{1}{W_{m} U_{m}} \int_{0}^{A_{m}} U_{2}^{2} \rho_{2} dA$$
 (4)

The density of the air at the mixing stack exit ρ_2 is a weighted average of the densities of the primary and secondary air flows. Assuming a secondary to primary mass flow ratio of 0.65, which is consistent with experimental results, ρ_2 is expressed as

$$\rho_2 = \rho_{avg}. = \frac{\rho_s}{1.65} [0.65 + \frac{T_s}{T_p}].$$
 (a)

Using this average density of the mixed flow, the mass flow rate leaving the mixing stack may be expressed as

$$W_{m} = \rho_{avg} \cdot U_{m}^{A} M$$
 (b)

where A has units of ft². Combining equations (4) and (b) results in an equation for the momentum correction factor



in terms of the experimentally determined mixing stack exit velocity profiles,

$$K_{\rm m} = \frac{1}{U_{\rm m}^2} \int_{\rm m}^{A_{\rm m}} U_2^2 dA$$
 (c)

Figure 36 illustrates the orientation of the two velocity traverses.

To integrate the mixing stack exit velocity over the three-dimensional velocity surface using only the two traverses requires making some approximations:

- Traverses A and B represent the maximum and minimum values of the velocity surface respectively.
- 2. The three-dimensional velocity surface is symmetrical, i.e. a velocity traverse passing above the other two primary nozzles, perpendicular to traverse A, is equal to that of traverse A and likewise for traverse
 B.
- 3. The circumferential variation of the velocity surface is sinusoidal with the maximum and minimum values at a given radius occurring at traverses A and B respectively.

The velocity traverse obtained experimentally consists of discrete points rather than a continuous curve. Each of these point values of velocity is representative of a radial element of the velocity traverse of length equal to the spacing between



successive points. The procedure is to fit a circumferential sinusoidal curve through the maximum and minimum velocities of traverses A and B respectively. Then treat this circumferential band as representing a segment of the velocity surface of incremental width dr equal to the spacing between the data points and integrate circumferentially over successive radial elements. Completion of the integration yields the actual momentum of the mixed gases leaving the exit of the mixing stack.



APPENDIX C

UNCERTAINTY ANALYSIS

The determination of the uncertainties in the experimentally determined pressure coefficients, pumping coefficients, and velocity profiles was made using the method described by Kline and McClintock [6]. The uncertainties obtained by Ellin [1] using the second order equation suggested by Kline and McClintock [6] are all applicable to the experimental work reported herein and are summarized in the following table.

TABLE XIV UNCERTAINTY IN MEASURED VALUES

		1
T _s	±	l °R
T _p	±	l °R
Pa	±	0.01 psia
ΔΡ	±	0.01 in. H ₂ O
$^{\mathrm{P}}\mathrm{_{V}}$	±	0.01 in. H ₂ O
Pu	±	0.05 in. H ₂ O
ΔP_s (†)	<u>+</u>	0.01 in. H ₂ O
Por	±	0.01 in. H ₂ O
$^{\Delta P}$ or	±	0.20 in. H ₂ O
Tor	±	l °R
Ta	±	l °R
PT (††)	±	0.1 in. H ₂ O



UNCERTAINTY IN CALCULATED VALUES

 $\frac{\Delta P^*}{T^*}$ 1.9 % W^*T^* 1.4 % V/V_{avq} 2.5 %

- (†) The pressure differential across the secondary flow nozzles, P, is the major source of uncertainty in the pumping coefficient.
- (++) The measurement of the total pressure for the velocity profile is the major source of uncertainty in the velocity calculation.



EPILOG

The authors feel that this has been a joint thesis in every phase of its production. From planning, fabrication, and testing through the computing and compiling of the data, we feel that both members of this thesis team have contributed equally. The rough drafts for the Introduction, Theory and Analysis, and Experimental Apparatus sections were written by Lt. Staehli. The rough drafts of the Experimental Methods and Experimental Results sections were written by Lt. Lemke. The Conclusions and Recommendations were by both authors as were the final corrections and additions to the rough copy.



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